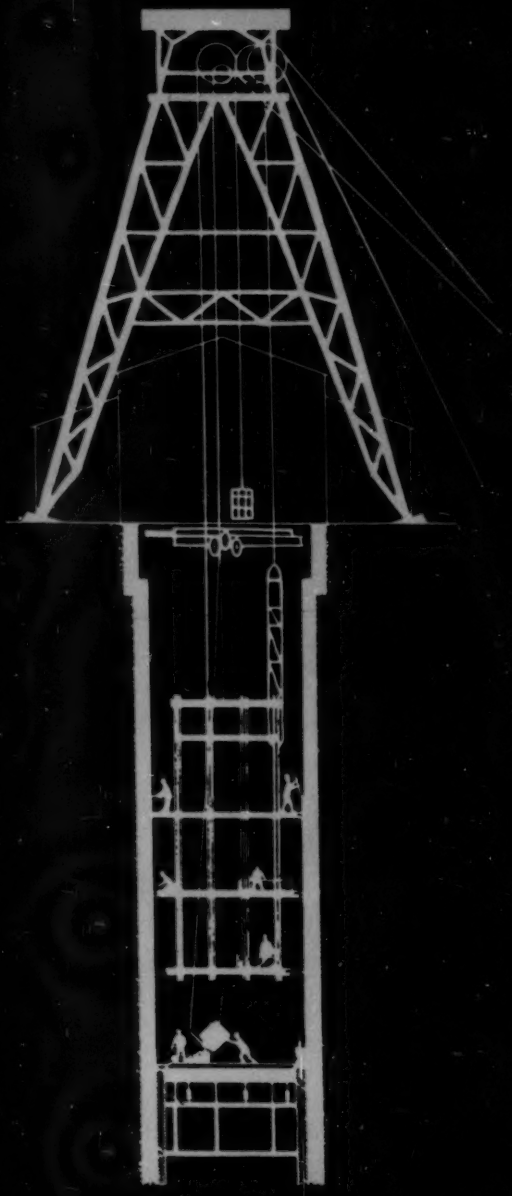
MINING WORLD

OCTOBER
1959



This Month:

Shaft Sinking Ideas from London

also . . .

Shattuck Denn Raises Mill Recovery 18% at Flotation-Cyanide Plant

Clayton Silver Bulldozes Ore to Drawpoints in Flat Shrink Stopes

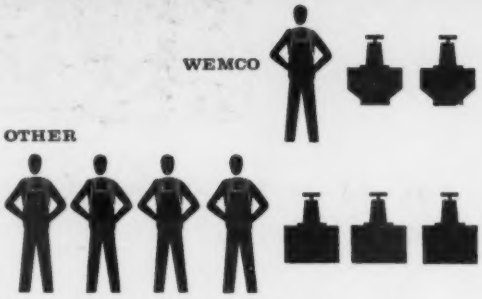
DMEA Inspired Project Becomes a Top U.S. Mica Producer

News from Behind the Scenes at AMC Convention in Denver

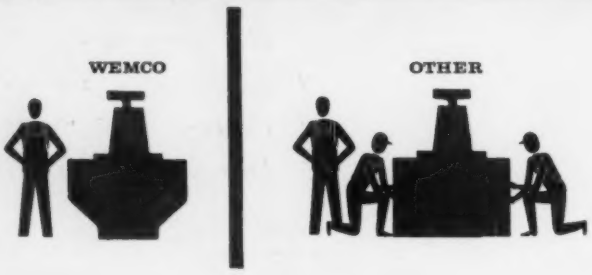
Government Calls for Bids on Land in California Borax District

Six Major U.S. Smelting Companies Protest Lead-Zinc Import Quotas

LABOR REQUIREMENTS REDUCED, MAINTENANCE COSTS CUT... WITH WEMCO-FAGERGREN FLOTATION



Fewer machines and fewer personnel



Lower maintenance

Wemco-Fagergren equipment costs less, *much* less, to operate! Operating labor is reduced because Fags need little or no adjustment to compensate for feed variations. Simplicity of design and operation assures fewer maintenance problems—and less cost. There is less wear and replacement of parts, less downtime because wear-exposed parts are rubber covered and an entire mechanism is easily removed for inspection and repair without shutdown of pulp flow.

This proved economy plus greater recovery adds up to consistent, profitable operation under the most demanding conditions! If flotation will do the job, Wemco-Fagergrens will do the job better, at less cost! Ask for complete information.

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a division of
Western Machinery Company, *Dept. M. W.*
650 Fifth St., San Francisco, Calif.
and throughout the world

5 reasons why Atlas Copco's "TIGER" is best for stoping and all short-hole drilling!

(1) It's fast and easy to handle!

(2) It's easy collaring, with little recoil!

(3) Features a retractable air leg!

(4) Convenient controls, automatic back head!

(5) Operates on single air supply!

Here's the TIGER—a new, fast, compact rock drill with power and stamina to meet toughest drilling requirements! Its high percussion rate not only speeds penetration, but at the same time cuts recoil to a minimum. With controls conveniently located, collaring is unusually easy.

What's more, the automatic back head prevents dry collaring. Flushing water actually flows before drilling starts. And, the Tiger's "constant blowing" provision sends air through the machine the instant pressure is turned on, keeping water and cuttings from the rotation chuck.

There's still another "plus"—the Tiger's exclusive integral type pusher leg, with retractable piston rod. Operates on a single air supply!

This isn't the whole story by any means. For more facts about the amazing new Tiger rock drill and how it can speed *your* drilling, call your nearest Atlas Copco representative. Or, write to us at Dept. MW-10.

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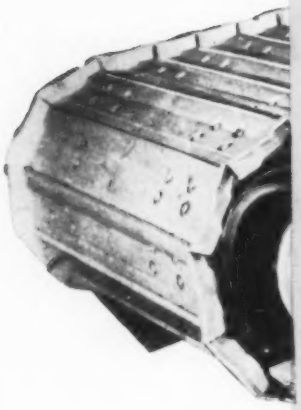
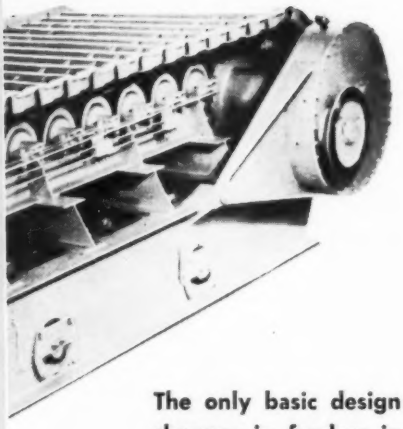
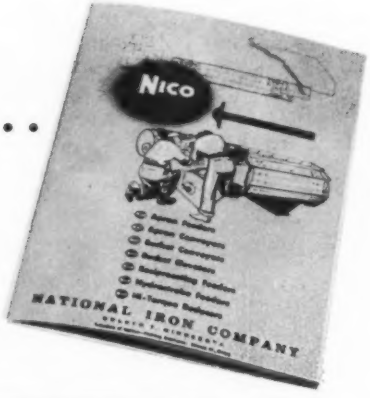




The only basic design changes in feeders in the past generation.

Learn the benefits of Modern Design . . .

Engineering Catalog 59-A (just released) tells the complete NICO Conveying story. Photos, detailed drawings, diagrams, together with engineering data and specifications make it an invaluable reference in determining the right feeder or conveyor. Ask your NICO representative or write direct for your copy.



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MINING WORLD

. . . . . including the Export Edition, WORLD MINING

VOL. 21 NO. 11 October, 1959

Borax Lands Opened to Bidding in Southern California desert by the United States Government 23

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MILLER FREEMAN PUBLICATIONS

GRAB SAMPLES From the Mail

Miner's 10 Commandments

1. Thou shalt not slumber in the morning, but shalt rise ere it is day and break thy fast, for he that goeth late to the mine getteth no candles, causing the transgressor to grope in the darkness and the shift boss to indulge in profanity.

2. Thou shalt not take up thy position in the center of the cage when descending or ascending the shaft, neither shalt thou appropriate in thy person more room than the law allows, for thou art of little consequence among a whole cage load of men, no matter what thou thinkest to the contrary.

3. Thou shalt not hesitate on the station, or smoke thy pipe and talk politics with the pump man, for verily the shift boss might suddenly appear, and heaven help thee if he findest the chute empty.

4. Thou shalt not mix waste with the ore, neither shalt thou mix ore with the waste, thou nor thy partner, nor the mucker within thy drift, for surely as thou doest these things the mine will stop paying dividends, and thy name will be "mud" over the length and breadth of the camp.

5. Thou shalt not eat onions when going on shift, even though they be as cheap as real estate in Clifton, unless thy partner participateth likewise, for that bulbous root exciteth hard feelings in the heart of the abstainer, and causeth the interior of the mine to be an unpleasant place.

6. Thou shalt not address thy boss by his Christian name, neither shalt thou contradict him when thou knowest he is lying, but thou shalt meekly say "Yes" or "No" to all he suggests, and laugh when he laughs and keep on laughing when he relateth a story, even though it be older than thy grandmother.

7. Thou shalt not steal thy neighbor's mops, nor his picks nor his drills; neither shalt thou carry away on thy person or in thy lunch basket low grade ore from the mine, for thou wilt find it will take a lifetime to obtain a mill-run.

8. Thou shalt not have an opinion concerning thy place of work, for thy employer payeth a fat salary to a School-of-Mines expert for constructing in his mind bonanzas that don't exist, so thou shalt refrain from theorizing and concentrate thy efforts on drilling and blasting of an abundance of powder.

9. Thou shalt not in order to breathe, steal from the drilling machine compressed air intended for drilling purposes. Thou shalt not go on strike lest thou be turned adrift on a cold and cheerless world; neither shalt thou demand thy pay, for the company's directors in the East know not that thou livest, neither care they a tinker's dam.

10. Thou shalt work and break ore every day, the Sabbath included, for verily the board of directors aforementioned hath assumed the prerogatives of the Almighty, and if thou refuseth to toil as they direct, thou and thy dog and all that thou possesseth will soon be hitting the trail for Tonopah.

ALAN REID
Inspector of Mines
Orange, New South Wales
Australia

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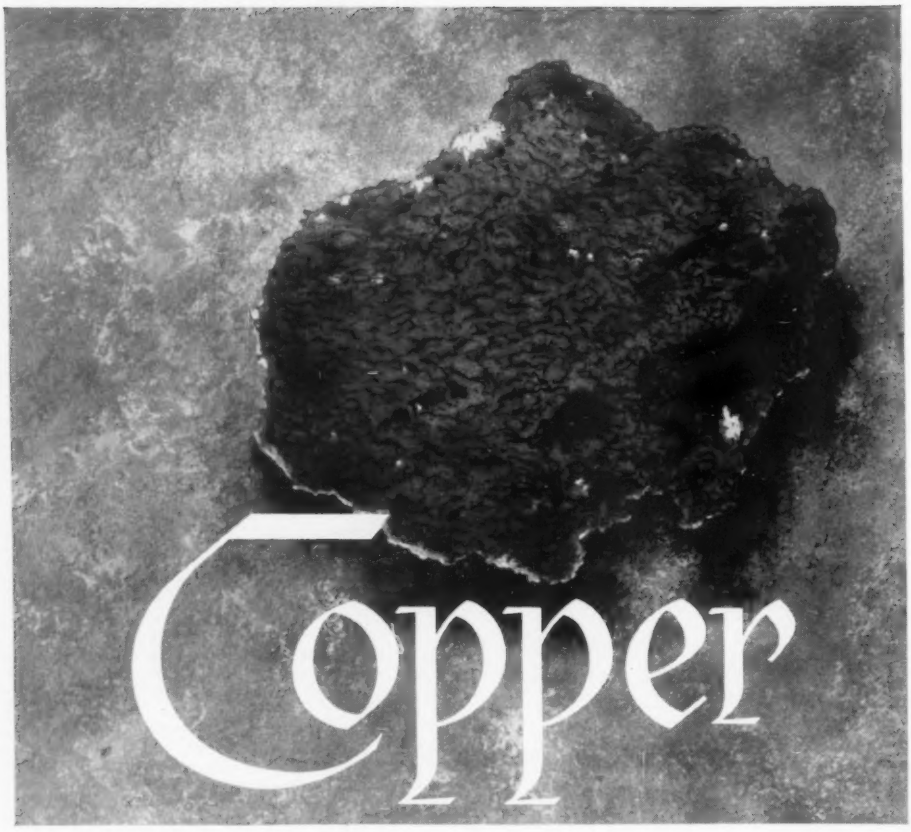
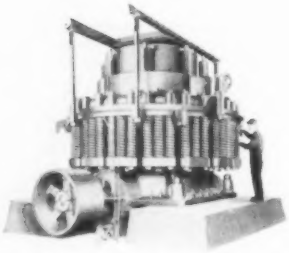


. . . symbol of money and power

The name *copper* is from the Greek κυπρος, Cyprus, one of the early sources of the metal. Copper has often been called "the common man's gold"—and has become a symbol of *money* due to its wide usage in the coins of many nations, as well as a symbol of *power*—since the greatest usage of copper has been as a conductor of electricity.

While native copper is the only metal found abundantly in nature, commercial production is supplied chiefly from various ores of copper, including chalcopyrite, chalcocite, cuprite and malachite.

Wherever these copper ores are processed—in Arizona, Chile, or the Belgian Congo—you'll find Symons Cone Crushers the leading choice among the world's prominent producers. For in copper . . . *as in all of the important ore and mineral operations around the world* . . . Symons Cone Crushers have consistently maintained their prominent position by efficiently processing large tonnages of finely crushed product at low cost.



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Americans Can Do It Too!

When E. R. Borcherdt, manager of Mining Research for The Anaconda Company, returned to the United States after attending the International Symposium on Shaft Sinking and Tunnelling at Olympia, London, England, he wrote a short report which appeared in the October 1959 issue of MINING WORLD.

He was very much impressed with the on-time performance of all speakers and the great value of the 10-minute question and answer period following a 10-minute summary by the author of his paper. This question and answer period was made possible by the pre-printing of all papers so that every Symposium registrant had a month or six weeks to study the paper before he arrived in London with well thought out questions and informative discussion.

Another most valuable and instructive procedure followed at Olympia was the presentation of only one paper at a time to avoid two common interest papers being presented at the same time.

The British don't have the monopoly on careful convention preparation, paper pre-printing, or non-competing speakers. The mining industry seconds Mr. Borcherdt's thought that The American Institute of Mining, Metallurgical, and Petroleum Engineers, and the American Mining Congress adopt a similar system.

Americans Can Do it, Too!

Meet Norman C. Ek

MINING WORLD's newest staff member, Norman C. Ek of Duluth, Minnesota, is so well known on the Iron Ranges that he needs no introduction to the iron mining industry. However, this will introduce Mr. Ek to all of MINING WORLD's readers in his new position as Chicago District Manager with headquarters at 1791 Howard Street, Chicago 26, Illinois.

For the last six years he has been employed as advertising manager for *Skillings Mining Review* with headquarters in Duluth. This gave him an opportunity for frequent trips to the various Iron Ranges where he worked closely with mining companies, equipment distributors, and equipment manufacturing companies.

Since graduation from Northwestern University with a B.S. degree in Business Administration, he has specialized in publication and advertising work. His first position was as production manager for Davidson Publishing Company in Duluth. He left the Iron Country only to serve Uncle Sam as a radarman aboard a Destroyer with duty in the Pacific Ocean Area.

This impressive installation at Kiruna, Sweden, demonstrates a major benefit of ASEA Multi-Rope Friction Hoists: *low initial installation cost.*

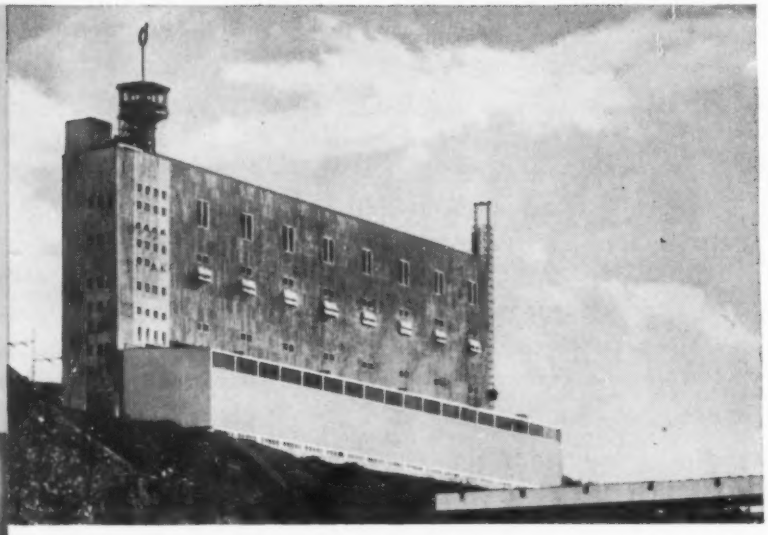
Each of these ASEA Hoists has a skipload of 22 tons and is designed for a depth of 1500 feet, maximum speed 2200 feet per minute.

At Kiruna, as in mining operations throughout the world, ASEA Multi-Rope Hoists prove less costly to operate, safer, and they reduce rope wear.

In the U.S. these advantages may be seen in the ASEA installations of National Potash Co. and The Cleveland-Cliffs Iron Company.

9 HOISTS IN ONE HEAD FRAME

Total capacity: 4600 tons per hour



FULLY AUTOMATIC, the ASEA Hoists at Kiruna eliminate the employment of hoist men.
At U.S. wage rates, assuming two-shift operation, this would mean a saving of about $30,000 yearly for each hoist!

Write for illustrated literature on ASEA Multi-Rope Friction-Drive Mine Hoists.

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MINING WORLD NEWSLETTER

October, 1959

FLOYD ODLUM GROUP ACQUIRES NEVADA BERYLLIUM DEPOSIT . . . Hidden Splendor Mining Co. purchases control of Mt. Wheeler Mines at Ely, with large low-grade disseminated beryllium deposit. Phenacite (Be_2SiO_4) and possibly a new mineral have been identified in mine workings in "Combined Metals" limestone bed. Bed also contains scheelite, lead and zinc. Grade apparently is just under 1.0% BeO. Metallurgical processing is under investigation.

BUNKER HILL SELECTS KELLOGG, IDAHO FOR MULTI-MILLION DOLLAR FERTILIZER PLANT. . . . Kennewick, Washington had also been considered. Construction of first unit --the phosphoric acid plant—starts immediately, at a site just below the electrolytic zinc plant.

A $200,000,000 CREDIT . . . will asist Quebec Cartier in development of its La Jeannine iron ore mine in Quebec. The project includes construction of a new harbor and loading facilities at Port Cartier, a 193-mile railroad, 69,000-hp. hydroelectric plant, and openpit mine and mill.

LURE OF AFRICAN GOLD . . . is attracting big companies to Southern Rhodesia. Even Rio Tinto and Rhodesian Selection Trust, usually base metal producers, are joining in on the search. Old mines are being reopened and large areas staked. Rio Tinto has six-month hold on Patchway mine at Gatooma, and options on surrounding properties.

WATCH TUCSON MOUNTAIN PARK AREA . . . for next copper boom in Nation's most active copper boom center. Sec'y of Interior has opened section of Park for mining. Bear Creek Mining Co. and Kern County Land Co. both have expressed interest.

U.S. GYPSUM WILL SPEND $1,000,000 IN MEXICO . . . to develop deposit 200 miles west of Tampico. Property is said to contain over 1,000,000,000 tons of commercial gypsum.

KENNECOTT RETURNS TO ALASKA . . . scene of its first big success. Firm has picked up option on Ruby Creek copper property north of Kobuk River where Bear Creek Mining Co., exploration subsidiary, has been test drilling for three seasons. Must be good; it costs money to mine north of Arctic Circle.

INTERNATIONAL TIN COUNCIL RAISES TIN QUOTA . . . for fourth quarter by 20% or 5,000 tons. The six producing nations can export 30,000 tons from Oct. 1 to Dec. 31, because of increased demand.

U.S. STEEL CHECKING CONSTRUCTION BIDS . . . for Atlantic City, Wwoming taconite openpit mine and mill. Two main contracts under discussion: one for "large dirt" contractors, involves building 60-mile railroad from Winton, large earth-fill dam at mill, and open-pit stripping. Morrison-Knudsen, Utah Construction, and Peter Kiewit all interested in this phase. Second contract is for crushing plant, magnetic mill, shipping facilities, and related items. U.S. Steel will procure all components for this, and subsidiary American Bridge Co. will erect all steel.

U.S. IS SELLING CUBAN NICKEL PLANT . . . at Nicaro. GSA will take bids until Dec. 1. Government has invested $85,000,000 in plant which has "proven production capacity" of 50,000,000 pounds of nickel oxide powder and sinter yearly.

HUMBLE OIL EVALUATING ALASKAN TITANIFERROUS MAGNETITE DEPOSIT . . . near Dillingham. Airborne magnetometer survey there last year outlined magnetite anomaly. Extensive drilling this season is to determine size and quality. Company had originally been seeking oil.

BEFORE You Buy a THICKENER...BE SURE!

USE DENVER Testing Service

TO DETERMINE CORRECT THICKENER SIZE FOR YOUR NEEDS.

No cost to you for this test service!

ELIMINATE RISK!

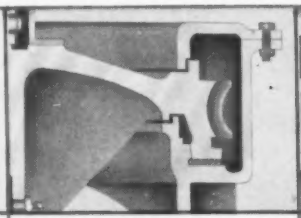
Let DENVER's 30 years of laboratory and world-wide field experience help you to eliminate risk—determine the right thickener for your needs—verify your own tests or recommendations of others. DENVER's experience covers a wide variety of materials plus the opportunity to relate test results to actual field operations. Laboratory tests, conducted at no cost to you, supply reliable data on

(A) Settling Rates **(D) Thickener Unit Area**
(B) Final Density **(E) Overflow Clarity**
(C) Effect of Flocculating Agents

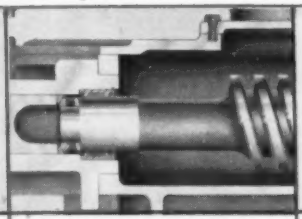
TESTS AT NO CHARGE—*These tests can assist you by eliminating risk of specifying a thickener that's too small to do the job or too large and costly for your needs.* Ship 5 gallon slurry sample prepaid to Denver Testing Division, 1755 Blake St., Denver, Colo.

Compare these distinctive features of DENVER Spiral Rake Thickeners:

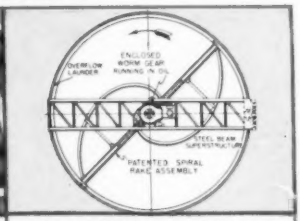
NEW ENCLOSED HOUSING protecting gear and drive mechanism is simple and rugged—available in sizes through 72" for light, medium, heavy and extra heavy duty. Tanks, steel or wood, in sizes to 150'. Write for Bulletin T5-B6.



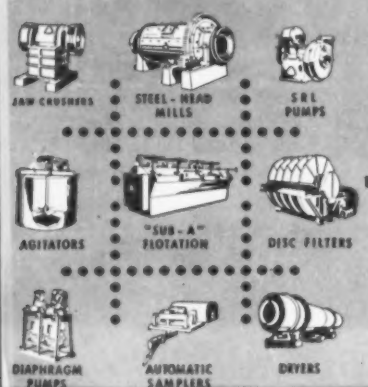
HIGH STRENGTH GEAR rides on replaceable no friction—no wear formica pads placed at periphery of the gear. Maximum stability, low bearing pressure and oil bath assure long life.



WORM AND WORM SHAFT are made from alloy steel, machined, case-hardened and ground. Shafts are proportioned to minimize deflection and retain full face gear-worm meshing.



SPIRAL RAKES move settled solids to center discharge port in only one revolution. Minimizes chance of choke-up, assures continuous operation. Why take 8 or 10 revolutions to bring pulp to the discharge cone when one revolution by the spiral rakes will do?



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CAPITOL CONCENTRATES

Decision Defines "Common Varieties"

An interesting and encouraging development in the "common varieties" cases (Public Law 167-84c), occurs in the decision on appeal in United States vs. Henry Wetmore, et al, Contest 1670 (Montana), rendered July 28, 1959. The field examiner was reversed by the Director of the Bureau of Land Management in Washington.

The case concerned a deposit of pumice, and the Hearing Examiner held "The deposit on the Sil-King No. 2 mining claim cannot be other than a common variety of pumice," and declared the mining claim "null and void," since the "chemical composition and commercial uses of pumice are the same throughout the world." The Examiner ignored testimony to the effect that this particular pumice has a physical characteristic which makes it valuable and duplicated only in deposits in Italy and New Mexico, and was reversed on these grounds.

A very encouraging policy statement was included in the decision, to-wit: "While the case is clearly one that might be decided either way, it is consistent with the long-continued policy of the Department to resolve a reasonable doubt in favor of a claimant who is presumed to have made his location and developed it in good faith." Hearing Examiners take heed!

OCDM Changes Its Story

It is an interesting thing that, from time to time in these columns, it has been pointed out that the pressure the Administration and ODM, now the Office of Civil and Defense Mobilization, has been applying to dispose of government stockpiles of critical and strategic materials took no account of the need of such materials for rehabilitation purposes in case of an atomic attack. It has been variously estimated that of the nearly $8,000,000,000 of such materials, some $4,000,000,000 were "surplus" to defense needs.

Whether or not Congressional criticism of such disposal was responsible, or whether the inclusion of the Civil Defense agency into ODM (now OCDM) had anything to do with the change of heart is difficult to estimate. At any rate, OCDM Director Leo Hoegh has recently testified before the Defense Production Committee that the entire situation is under review to determine how much of the materials will be required to rebuild the nation's industries in case of an atomic attack.

As a new concept by the agency, Mr. Hoegh remarked, the "availability of basic materials would play a major part in getting industry back on its feet after an attack." Under this concept he reduced the "surplus" to $2,000,000,000 as an estimate before the new "review" is finished. This comes back to the old saying that "if you don't know what you need you probably don't have enough!"

Bill Proposes Disposal of Surpluses

Plans for eventual disposal of stockpile "surpluses" are progressing rapidly. A bill for that purpose was transmitted to the Congress by the Administration.

It would consolidate in a new agency within GSA, to be known as the Materials Reserve Agency, all the materials in the barter (supplemental) stockpile, the GSA inventories, and all the overage in the national stockpile caused by the reduction of the estimated length of the next war from five to three years. The new plan of disposal is supposed to be surrounded by various safeguards such as a 90-day warning to the Congress and marketing plans which will not disrupt prices.

There is little chance that such a bill will pass this year.

Reveals How Barter Works

The report on the Cooley amendment (H. R. 8609) to alter the barter provisions of Public Law 480 contains so much information pro and con on how barter works that it will be very interesting to those interested in the domestic mining industry. This House of Representatives Report No. 908, to accompany H. R. 8609, may be obtained from the House Committee on Agriculture.

Commerce Secretary Put On Spot

On August 13, 1959, the Senate Interior Committee examined the new Secretary of Commerce, Frederick H. Mueller, concerning the Commerce Department's attitude toward the domestic mining industry. This arose from the fact that Commerce had opposed the Aspinall mineral policy resolution.

Interior Committee chairman Murray, among other remarks in his opening statement, said, in part, "you seemed to be trying to leave the impression that all you are opposed to is the expansion of our domestic minerals production—that it will be all right with you if present levels of production are just maintained. This philosophy, strange and alien for a Secretary of Commerce to embrace, does not offer any solution for the owners and operators of domestic tungsten, fluorspar, manganese, chrome, antimony, cobalt, lead, and zinc mines that have been forced to shut down in recent months because of the impact of foreign imports."

The Secretary, being responsible for both foreign and domestic commerce, was really on a spot and he attempted to pass the buck to the Interior Department as being responsible for the minerals industry. The Committee felt, and said so, that Commerce has a large responsibility also.

Addressing himself to Senator James E. Murray's S. J. Res. 107, Mueller remarked, "I should like to raise a question about the policy of achieving a maximum degree of self-sufficiency. Depending on the extent to which this is carried out, this policy could have a significant impact on our foreign trade policy. . . ." It undoubtedly was intended to have! Of the several bills on policy before the Senate Interior Committee the Secretary naturally preferred, if any, the mildest of the group, S. 1537, which also was preferred by the Interior Department.

Since his appearance before the Senate Appropriations Committee, where he was asked several pertinent questions by mining-minded Senators, Secretary Mueller has modified his position almost radically to a much more liberal viewpoint.

One other pertinent remark, after being asked if he thought there is anything wrong with an American having a fair share of the American market, the Secretary answered, "No, I have advocated that myself."

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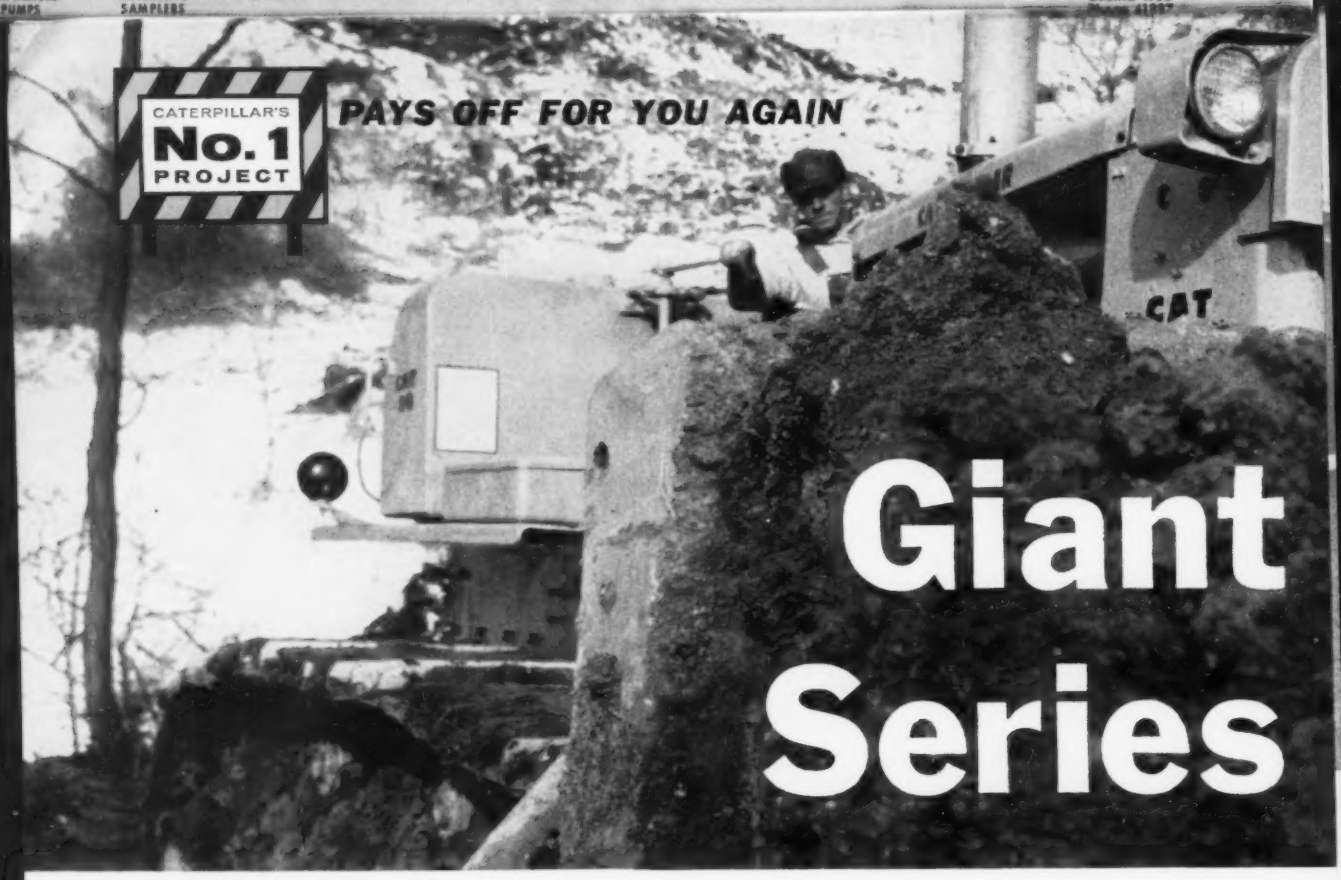


Giant Series

New power! New design! New features! Plus a new drive option—Cat power shift transmission! The result: higher production on any application!

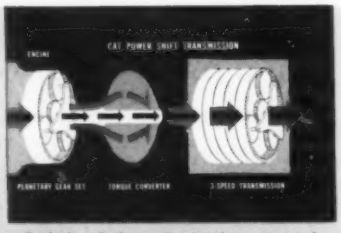
Now the "King of the Crawlers" is better than ever with new pace-setting capacity for higher, faster, lower-cost production on *any* big tractor application!

The biggest "new look" in the giant D9 Series E is the undercarriage. It's more massive . . . more rugged than ever. It'll add hours of life to running gear on even the toughest jobs. *Every* track component is new in design, highlighted by a big, new link—its pitch is increased 1¼" to 10¼"! And a new Caterpillar-developed steel alloy strengthens links, shoes, rollers *up to 40%!*

That's not all: the new D9 packs more power—335 HP. Its new equalizer bar gives greater stability on any terrain for greater operator confidence and production. A wider seat with a new spring-loaded adjustment mechanism makes the operator more comfortable, more efficient. No detail has been overlooked to make the new D9 handle heavier loads faster—and at lower operating and maintenance costs than ever.

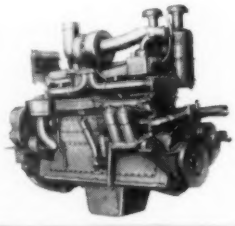
And that's not all. Now, along with direct drive and torque converter, you have your choice of the new Cat

Dry-type air cleaner. Removes at least 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes. Reduces maintenance time and cost.



Exclusive feature. A planetary gear set splits the power from the engine. Part goes directly to the 3-speed transmission, the rest goes through a torque converter to transmission.

New sprocket. Sprocket is strengthened by new design with increased tooth thickness. Hunting tooth action provides slower wear rate.

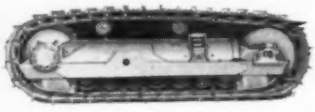


New 335 HP. More powerful than ever, the D9's Turbocharged Engine has the capacity to handle bigger loads faster, with dependability, economy.

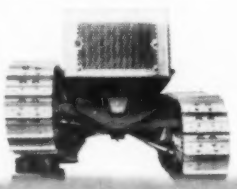
New Turbocharger. New, compact turbocharger packs more air into the engine. Open impeller wheel (shown below) helps prevent dirt build-up.

New power shift transmission. Optional on the D9. With this development you can shift **on-the-go** under **full** load with **one** lever and **no** clutching in a split second!

New, bigger, more rugged undercarriage. Major improvements in all track components add hundreds of hours of life to running gear—hours that mean more time on the job.



New equalizer bar. Greater stability. The rocking action of the bar shifts more weight to the up-hill track.



new CAT D9 E Tractor

power shift transmission. This revolutionary transmission, tested under the most rugged conditions, combines for the *first* time the positive feel of direct drive with the flexibility and anti-stall features of torque converter. With one control lever and no clutching, it reverses direction . . . changes speed . . . smoothly . . . under full load . . . in a split second!

Many of the new features, along with some familiar retained features, are shown here. They'll give you an idea *why* the new D9 can mean higher production and more profits for you. For complete facts, see your Caterpillar Dealer. Ask for a demonstration and watch this giant eat up the work!

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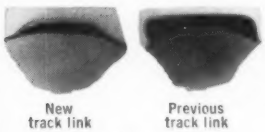
NEW D9 SERIES E— BORN OF RESEARCH PROVED IN THE FIELD

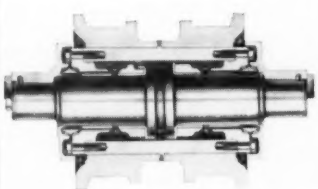


New track link — Previous track link

Light area at top indicates depth of hardening

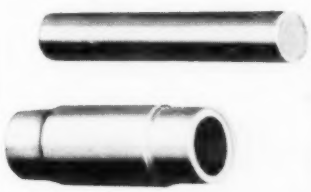
New deep hardening steel. Caterpillar-developed steel alloy (plus more steel in stress areas) gives up to 40% longer life to track shoes, links and rollers.

Better visibility. Redesigned fuel tank gives better visibility to the rear and tapered hood offers unexcelled forward vision.



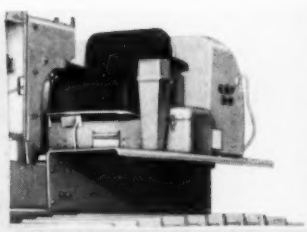
Lifetime lubricated track rollers. Lifetime lubrication eliminates servicing problems. Oil is retained by dirt-proof, floating-ring seals.

Stronger track shoes. New alloy permits deeper hardening in wear areas. Grouser height is increased 3/8" for better penetration and prolonged service life.



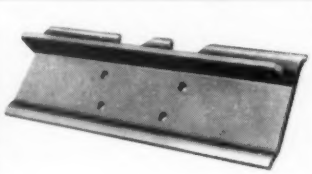
Larger pins and bushings. Diameters are 1/4" larger. Increased size reduces deflection and provides better contact along the length of the wear surfaces.

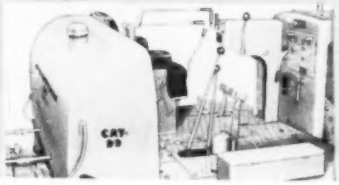
New foot decelerator. Provides easier machine positioning. Allows deceleration without taking hands from controls (optional on direct drive, standard on others).



New seat adjustment. New spring-loaded adjustment mechanism provides more positive cushion and back rest positioning. Wider seat for more comfort.

Bigger, heavier track links. Strength has been added in stress areas. Pitch increase from 9" to 10 1/4" strengthens all track components.





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The new levels of output and efficiency made possible on operations that can use large haulage units make the Marion 181-M a logical machine for expanded pit mining operations.

Here's a husky 9-yard machine with the traditional strength, power and endurance of Marion mining shovels - - plus small machine cycle time for an extra payoff every day.

With low-maintenance Ward-Leonard controls, power is applied smoothy and quickly, yet held within controlled limits that safeguard the machine against undue shocks or strains.

The chain propel simplifies crawler design and provides increased protection for the final propel mechanism, especially on shovels where the drive chain is enclosed and dips in oil.

A disc-type air clutch permits the operator to engage the travel mechanism without stopping the machinery, permitting faster move-ups.

If you haven't seen Bulletin 439 on this 9-yard Marion, write for your copy today.

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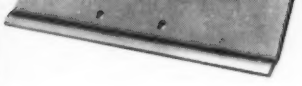

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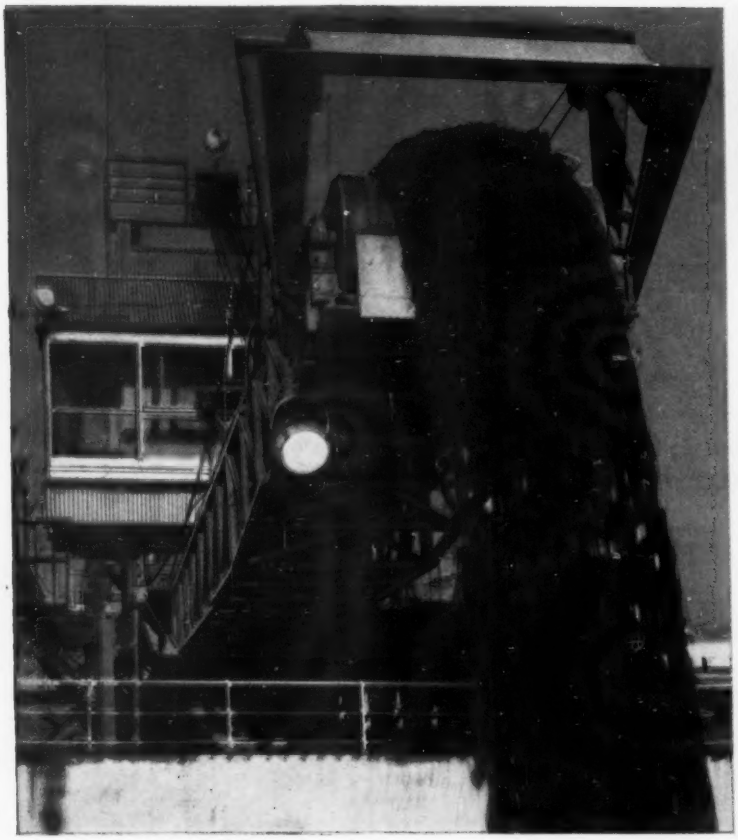

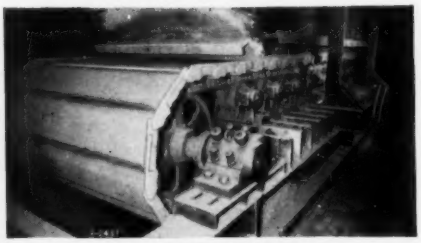

Giant S-A AMSCO Feeder

S-A Stockpiling Conveyor System

S-A Twin Shiploading System

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At the left, ore is shown pouring into a ship's hold at an average rate of more than 4,000 long tons per hour from one of two giant STEPHENS-ADAMSON boom conveyors at Sept. Iles, Quebec. The STEPHENS-ADAMSON equipped ship-loading facilities believed to be the largest capacity in the world — handles as many as seven ore vessels a day and nearly 10,000,000 tons of ore a year.

STEPHENS-ADAMSON is proud to have been selected to equip the ship-loading facilities and other ore handling operations of the huge Quebec-Labrador project — one of the most far-reaching construction projects ever undertaken.

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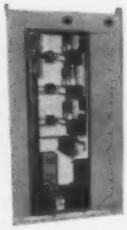
THE BETTER WAY

The P&H way—"the better way" of design and construction puts P&H Electric Shovels in a class by themselves—they alone are not essentially the same as the shovels of a generation ago.

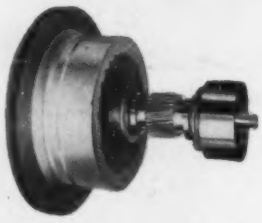
P&H has always been the pioneer developer of dramatic new designs and processes—this is why P&H Electric Shovels incorporate design fundamentals which make them different from all others. By their pioneering, P&H found "the better way" to production premiums as high as 10%, lower unit cost and more net profit for P&H owners.

Some exclusive P&H design fundamentals not found in other electric shovels are:



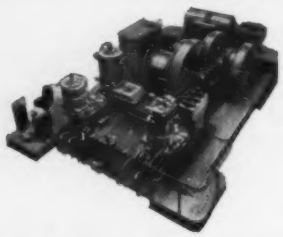
1. ELECTRONIC CONTROL

This patented P&H control accomplishes the quickest work motion reaction time known for electric shovels. Control maintenance expense is reduced as much as 80% by elimination of all moving parts for a completely closed circuit system.



2. MAGNETORQUE® HOIST DRIVE

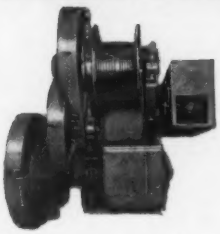
This patented hoist drive electro-magnetically transmits the full digging power of an A.C. motor direct to the dipper without motor generator set conversion to D.C. current! It gives up to 30% higher bail pull for more uniform digging speed and greater dipper fill factor.

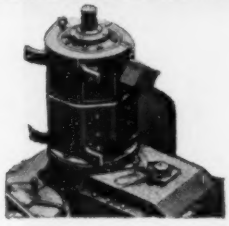


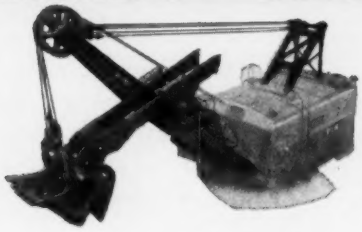
3. FULL WELDED STEEL CONSTRUCTION

P&H was the originator of electric shovel construction by the unit welded rolled steel method. Their accumulated wealth of experience pays P&H owner dividends in the form of exceptional long shovel life in hard digging—accomplished by full welded steel construction.

"P&H is now the world's largest builder of full-electric and diesel-electric shovels. Only P&H manufactures their own electrical as well as mechanical components—designed specifically for electric shovel service—gives you the service assurance of single source responsibility."







4. ENCLOSED HOIST MACHINERY

Only on the P&H Shovel is all deck machinery—the power trains for hoist, swing and propel drives—enclosed in oil tight gear cases. No open gearings! Modern power train design at its best!

5. INDEPENDENT CRAWLER PROPEL MOTOR

Only P&H Electric Shovels have an independently motored crawler propel drive. P&H gives shovel owners the advantages of independent motoring—the basic principle of electric shovel design and purpose. The P&H is FULL-ELECTRIC in every work motion.

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Many operators throughout the world know the economy and rugged dependability of Traylor-Made Jaw Crushers. Over 50 years of experience results in many advantages for the user of these crushers.

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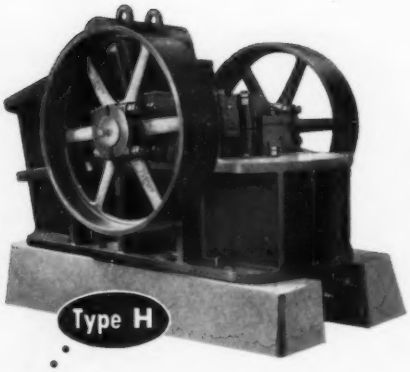
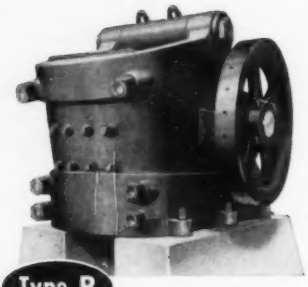
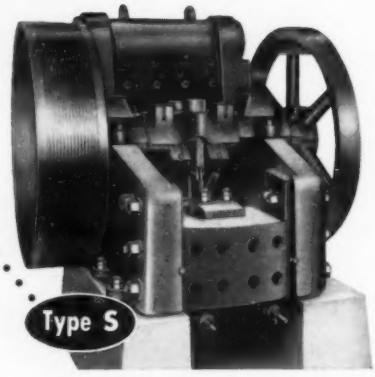
Some of the features incorporated in Traylor Jaw Crushers are jaw plates of the Traylor curved type—the pitman shaft is made of annealed open hearth forged steel. The swing jaw is made of cast steel of extra heavy design for maximum strength. For more of the features of Traylor Jaw Crushers, write to Traylor today.







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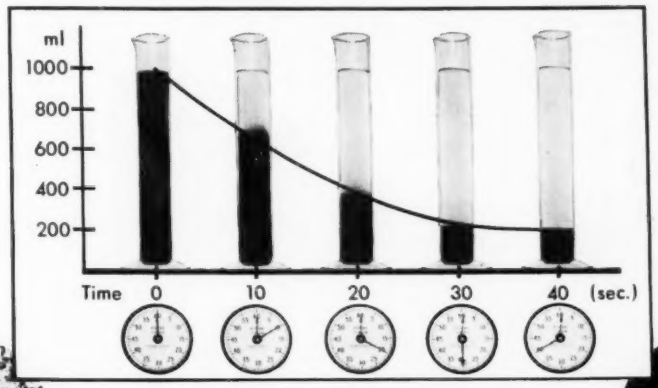

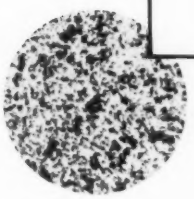

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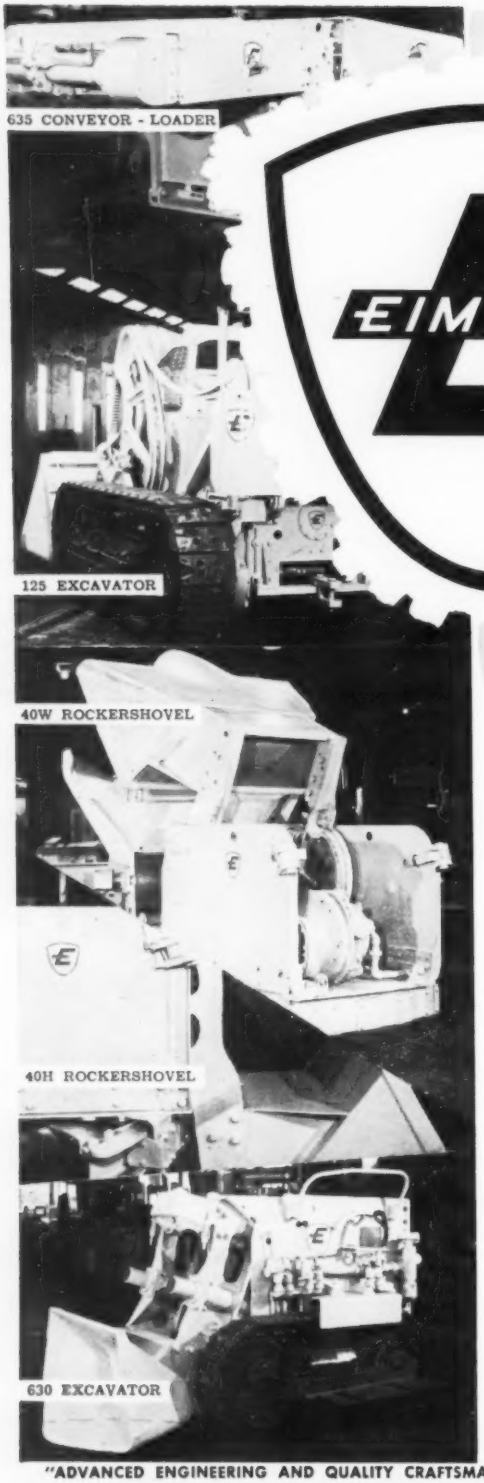

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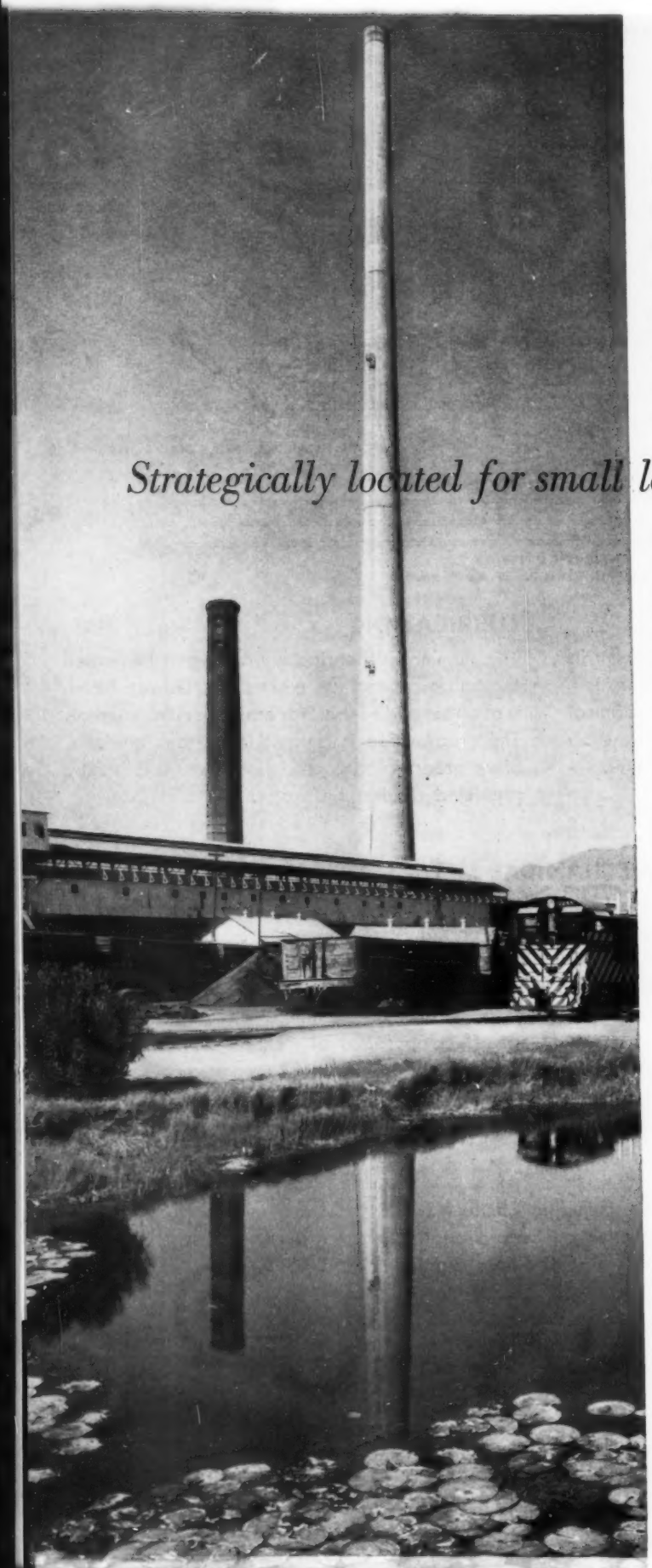

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COPPER SMELTERS
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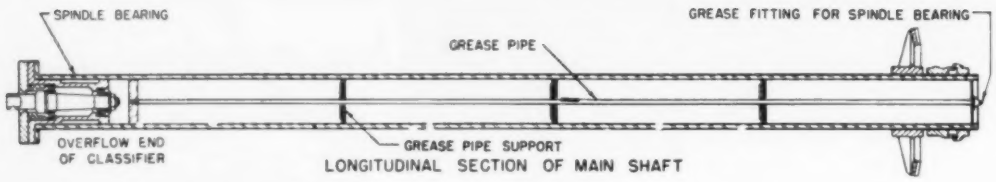
which assure low-cost, trouble-free operation of classifiers, heavy media separators and densifiers



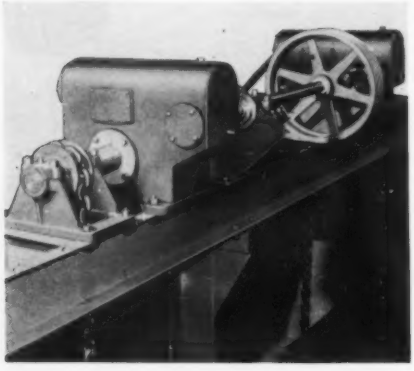
LONGITUDINAL SECTION OF MAIN SHAFT

SUBMERGED BEARING

The patented submerged bearing has proven its advantages of durability, trouble-free operation, and ease of maintenance. Special mechanical design results in long bearing life; effective sealing prevents entry of pulp into bearing unit.

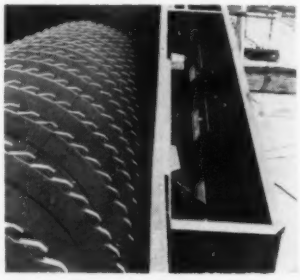
LUBRICATION

The submerged bearing is grease-gun lubricated through a pipe in the main shaft. Grease fitting is at upper end of shaft for maximum convenience. The grease pipe is isolated from tank contents. Since grease pipe is inside main shaft, it is fully protected against breakage.



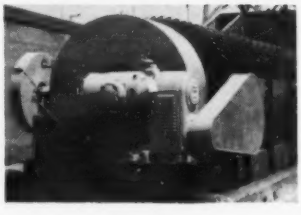
MECHANICAL LIFTING MECHANISM

The lifting device consists of chains, chain sprocket sheaves, and motor-driven or hand-operated reducer unit. Experience has proven this mechanical arrangement to be the most positive, with no possibility of slippage... a factor of particular importance on densifiers. Minimum maintenance. Slimes or sands on chain do not affect operation of mechanism. No packing glands or rods to become worn.



WEARING SHOES

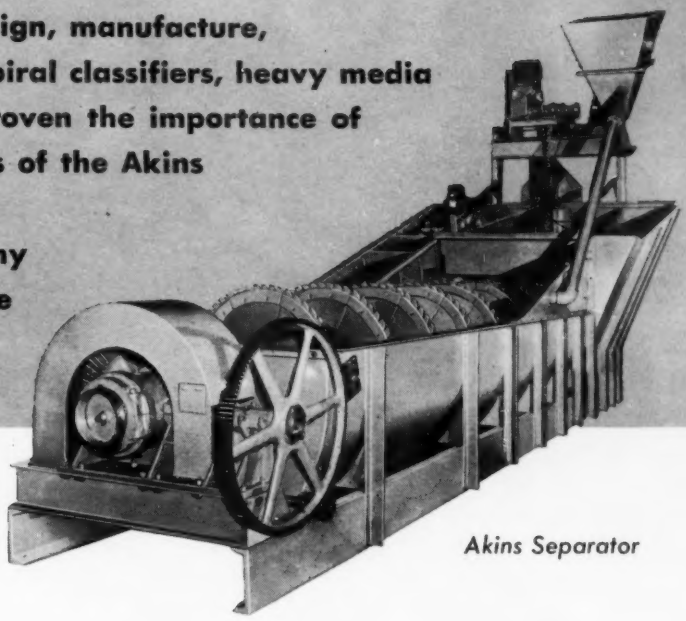
Wearing shoes are made of various alloys, including Climax 42-A. The patented serrated wearing shoes are effective on certain applications to improve drainage and reduce wear; they also facilitate digging the spiral into a partly solidified bed after shutdown. Special inner shoes are provided for heavy rake loads.



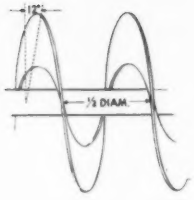
DRIVE

The bevel gear, V-belt drive has proven to be the most trouble-free and flexible. It permits mounting the motor, or motor-reducer, horizontally; and changing speeds quickly and inexpensively, by simply changing V-belt sheave ratio.

50 years of experience in the design, manufacture, and operating performance of spiral classifiers, heavy media separators and densifiers, has proven the importance of the exclusive mechanical features of the Akins machines... importance in terms of metallurgy, and in the economy of long, trouble-free operating life with minimum maintenance.

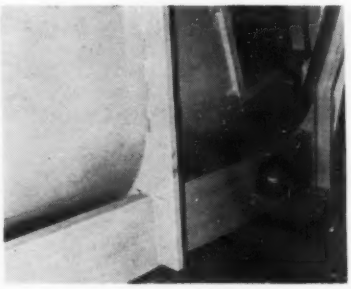


Akins Separator



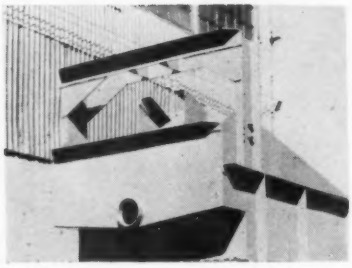
SPIRAL PITCH

50 years of experience has shown that the half-diameter pitch gives maximum raking capacity and results in less slippage and less wear than advanced pitch spirals.



TANK SUPPORTS

Web beam substructure supports tank. There's no load to be carried by tank. This also reduces installation cost by eliminating need for extra sub-structures to support tank.



OVERFLOW BOX

An overflow box, with a pipe connection, is furnished as standard . . . requires only a single connection.

Specialized engineering and laboratory testing services available for ore-milling problems.

For complete information on Akins machines write for catalogs.

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SALES AGENTS in Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in principal cities of the United States.

"Spotty, as a digger, you just ain't got it!"

Without realizing it, Billy has hit upon a basic truth in the excavating business. To come out on top, you've got to use the best equipment for the job.

With many factors beyond a contractor's control, choosing the right equipment becomes especially important. For this is one thing a man *can* control.

That's why so many contractors choose Bucyrus-Erie. They have learned . . . as their fathers did before them . . . that B-E machines are built for more than ordinary digging. They are built to handle the toughest jobs — and still perform better.

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Open Bidding for California Sodium Lease

The announcement by the U.S. Bureau of Land Management that it will auction a 10-acre parcel for a sodium lease to the highest bidder on October 16, 1959 draws attention to the recent exploration for boron minerals in Kern and San Bernadino counties, California. While the lease is for "sodium," actually it is the sodium borate minerals—tincal ($Na_2B_4O_7 \cdot 10H_2O$) and kernite ($Na_2B_4O_7 \cdot 4H_2O$)—that are valuable.

Location of the 10-acre rectangular parcel is shown at end of black arrow on the accompanying map. Also shown is the open-pit mine of Pacific Coast Borax Company, in Section 23.

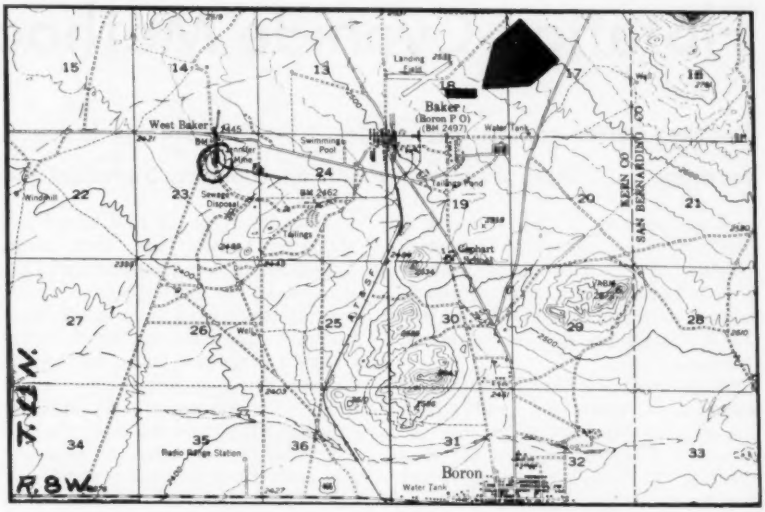
Pacific Coast Borax controls large acreage in Kern County; the Mudd interests of Los Angeles control about 400 acres in the vicinity of the old No. 3 shaft of the Western Borax mine of Borax Consolidated of England.

At least four major companies have conducted extensive geological surveys, formation drilling, and, in some cases, drilling to block out boron reserves in the area. Most of this has been just east of the map area. Apparently, Kern County Land Company has the largest holdings and has announced the discovery of a 40,000,000-ton deposit of colemanite ($Ca_2B_6O_{11} \cdot 5H_2O$), east of Boron. It is known that Kern County has drilled Section 30, T. 11 N., R. 6 W.

Sunray Midcontinent Oil Company has drilled about two miles north of Kern County Land and has found boron mineralization. Kerr McGee Oil Company has drilled two miles northeast, and Phelps Dodge Corporation has drilled 15 miles southeast.

Independent geologists believe much of this drilling has been based on geophysical survey data. Search has been made for buried basins in the bedrock as logical drilling targets because the boron ore deposits do not crop out. However, many of these basins have proved to be boulder and rubble filled.

The 10-acre parcel being offered for lease by the Bureau applies to N½S½NW¼SE¼ Section 18, T. 11 N., R. 7 W., S.B.M. Sealed bids containing one-fifth of the bid amount must be in the hands of the Bureau's Land Office in Los Angeles before 10 a.m. P.S.T. on October 16. Minimum bid is $1 per acre. A minimum royalty of 5 percent of gross value of output during first 20 years after execution of lease will be paid monthly. After six years, a minimum annual production of the deposits to a royalty value of not less than $1 per acre, or in lieu of any mining, to pay a royalty in an amount sufficient to make the royalty total $1 per acre. A $5,000 lease bond is required.



Lead-Zinc Firms Unite Against Quotas

Six major U.S.A. lead and zinc smelting companies have joined together in strong opposition to the present government quotas on lead and zinc imports. They have recommended to the Department of Commerce that quotas on unmanufactured lead and zinc be rescinded as soon as possible, and increases in appropriate customs duties be substituted. They also urge compensatory duty treatment for certain selected lead and zinc products to protect domestic fabricators.

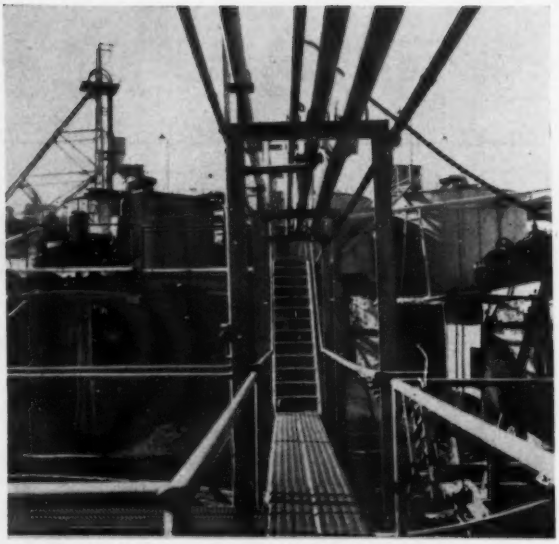
The group is composed of American Smelting and Refining Company; American, Zinc Lead and Smelting Company; Athletic Mining and Smelting Company; Blackwell Zinc Company, Inc.; Matthiessen & Hegeler Zinc Company; and National Zinc Company.

Representing about 50 percent of the domestic lead and zinc smelting and refining capacity, they claim that the effect of the last year under the President's import quotas has been to "cause major dislocation of lead and zinc raw material supplies" and "financial hardships and metallurgical difficulties to the domestic smelting industry."

They predict that prolonging of the quota system will jeopardize continuation of a healthy competitive domestic custom smelting industry; that artificial reduction of raw material supplies will deny a segment of the smelting industry the ability to continue in business.

BUCYRUS ERIE

FLOTATION is used to recover lead, then zinc, in differential circuits. Lead side is operated to pull as much gold, silver, and copper into lead concentrate without contaminating the concentrate grade with too much iron sulphide.



CYANIDE PLANT once treated final flotation tailing, but now operates on tailing from lead cleaner flotation. Cyanide plant residue is recycled to lead scavangers after treatment with $FeSO_4$ to complex cyanide ion.

Flotation-Cyanide Methods Overhauled

Results: Better concentrate grades. . . . Sharp gains in metal recovery. . . . More dollars wrung from complex, 5-product ore

Three changes in the treatment of Shattuck Denn Mining Company's sulphide ore of lead-zinc-gold-silver-copper have contributed most significantly to better metallurgy at the 1,000 ton-per-day mill near Prescott, Arizona.

They include: (1) The use of stronger promoters for gold within the lead flotation circuit and the use of more selective reagents for zinc flotation. (2) The addition of a regrind circuit to the lead flotation section; this provided better lead recovery and concentrate grade through the medium of a finer grind. (3) A change in cyanide treatment from the processing of final zinc flotation tailing to a feed taken from the flotation tailing of the lead regrind section; this allowed some sacrifice in the recovery of gold within the lead circuit so that grade of lead concentrate could be improved. A prime objective at the mill is to put the gold with either the lead sulphide concentrate or cyanide precipitate because it is paid for at a higher rate in these products than in zinc sulphide concentrate.

In addition to the above factors which were chiefly responsible for better metallurgy at the mill, many mechanical changes have been made. The latter, though contributing to the general overall efficiency of the mill, can not be equated in terms of direct benefit to grade of concentrate or recovery. Chief among these mechanical changes is a new filter plant with enlarged concentrate storage capacity, enlarged filter capacity, and in which the inclusion of adequate sumping and wash-down facilities prevent possible losses after the concentrate is made.

In the crushing circuit, efficiency was improved through closer control of particle size produced for the ball mills (minus-¾-inch). Uniformity of feed to the grinding section has benefited from rebuilding crushed ore storage so that five separate bins with five 1-foot square draw-down holes, were joined to make a single storage unit which is emptied from a 22-foot bottom opening. This minimized the effect of particle segregation, resulting in more uniform feed to grinding at all times.

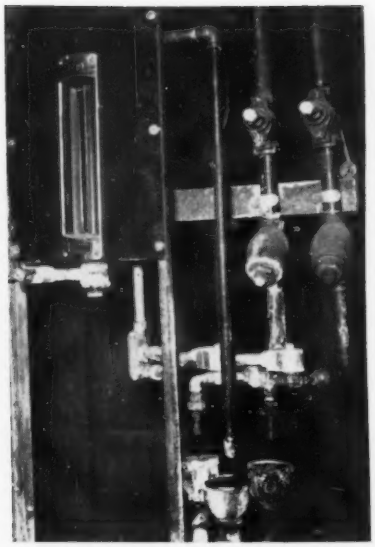
In the grinding circuit, cyclones have been substituted for mechanical classifiers and have produced an improved grind. The scrubbing action of cyclones help condition mineral surfaces for flotation.

Other modifications to the plant include provision for centralized reagent mixing; installation of enlarged sumping facilities for the mill pumps; and various operating ideas contributed by employees.

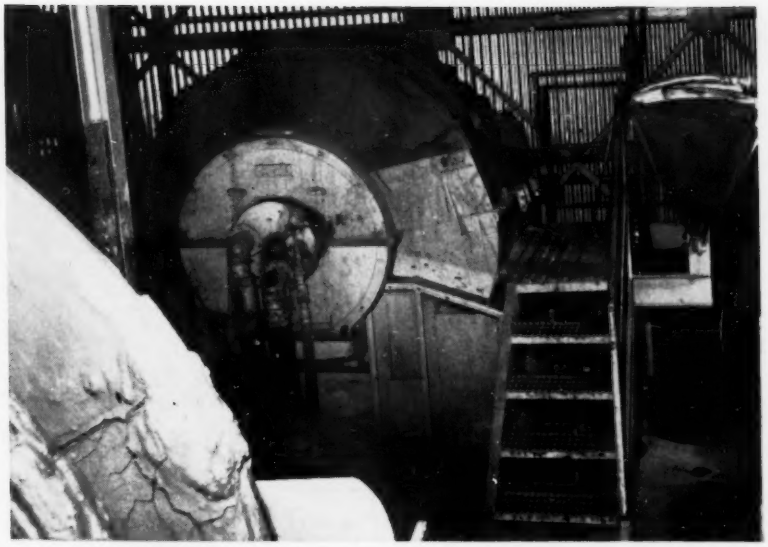
Economic Recovery Goes Up

Lumping all these seemingly insignificant changes together has made a profound effect on metallurgical results at the mill. In January 1959, economic recovery of lead, zinc, gold, silver, and copper from the ore was a little over 84 percent. Three years ago, a figure of 66 percent was standard practice.

The term "economic recovery" is a particularly realistic manner of expressing metallurgy at Shattuck Denn's Iron King operation. It is simply the ratio of net smelter returns (in dollars) to the recoverable value of the metal in the ore (also dollars). Economic recovery is a valuable concept for any plant treating ore containing several products. The recoverable value of the ore is based on the prevailing current market prices of the metals contained in the three products of the mill—lead concentrate, zinc concentrate, and cyanide precipitate.



REAGENT CHANGES in lead and zinc circuits have had a pronounced effect on metallurgical improvements; above reagents are fed through solenoid valves.



NEW FILTER PLANT provided mechanical operating improvements that led to increased flexibility. Capacity was enlarged and a concrete loading pad with separate sumps for lead and zinc concentrates was installed. Eimco filter in picture is a 6-foot-diameter, 4-disc unit handling lead concentrate.

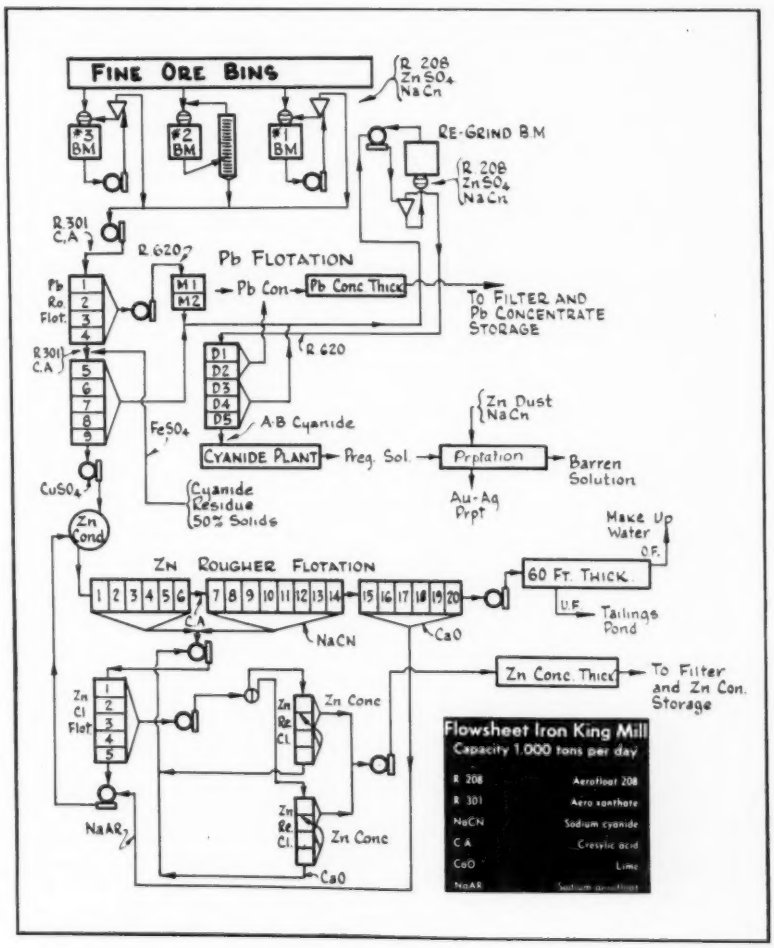
at Iron King

It takes into consideration the grade of concentrate, freight, and smelter treatment charges. Mill standards for purpose of calculation of the value of the ore had been set at a 30 percent lead concentrate and a 50 percent zinc concentrate a number of years ago. Today, however, as a result of the metallurgical development program, grades are somewhat better—33 percent lead in lead concentrate, 56 percent zinc in zinc concentrate.

Treatment For Profits

These standards may seem low, but the complexity of the Iron King ore has made it necessary to slant milling operations toward maximum dollar return rather than emphasizing grade of concentrate produced. Mill feed of 3 percent lead, 8.5 percent zinc, 0.18 percent copper, 0.12 ounces of gold, and 3 ounces of silver is typical of a day's run. A recoverable value of the metal in the ore of $15.00 per ton is fairly representative of the feed at current metal prices, freight and treatment charges.

The ore is very fine grained and a large proportion consists of massive sulphides in which pyrite may compose 50 percent of the ore mineralization. The lead occurs in galena and the zinc as sphalerile phalerite. The ore is contained in a gangue of chlori-



Three Operating Ideas from Shattuck Denn

SLIDER BOXES on diaphragm pumps are used to divert pulp flow; same pump can be used to recirculate pulp.

FILTER AID consists of Tween 81 in fuel oil emulsifier; aded to zinc filter, it cuts cake moisture.

TIMERS are set to open solenoid valves on reagent feeders for x number of seconds during a one minute cycle.

tic schists. It is thought that a certain amount of free gold and silver exists in the ore, but the major proportion is closely associated with the pyrite. Both the gold and silver values are extremely important to the profit picture because a significant amount of the recoverable value of the ore (40 to 50%) is derived from these two metals.

Microscopic investigations show that the ore minerals are locked with iron sulphides at extremely fine size ranges. A grind of minus-20-microns would be required for good liberation; however recovery would be complicated by slimes if the ore was ground to such a size range.

Several years ago, gold and silver were recovered by pulling a pyrite flotation concentrate from the lead-zinc flotation tailing. This concentrate was shipped to a smelter and payment was made on the basis of the gold and silver content. The outlet for the marketable pyrite concentrate dried up, however, and the company began to cyanide the plant tailing to recover the precious metals.

In this method of operation, the lead circuit was manipulated to pull most of the gold and silver into the lead flotation concentrate so that a minimum amount of the precious metals reported to the zinc concentrate. The cyanide plant, which followed zinc flotation, was primarily a scavenging operation to insure clean tailing. In order to make a high recovery of gold in the lead circuit, it was necessary to float a great deal of pyrite with the galena. The result was a high-iron, lead concentrate with a lead content of 20 to 25 percent.

The changes in the present mill practice have made it possible to slightly reduce the emphasis on high gold recovery in the lead circuit, though it still remains a strong factor in the economic picture. In recent years, an increase in freight rates on concentrates has taken place on nearly an annual basis. Thus a point was reached where it became important to make improvements in the grade of concentrates produced at the mill.

Rejecting Iron From Lead

In meeting this objective, the natural course was to drop some of the iron from the lead concentrate. This was to be done without sacrificing gold to the zinc concentrate where payment for gold would be made at a lower rate.

In the lead flotation circuit Aerofloat 208 and Aeroreagent 301 were substituted for Aerofloat 404 collector and an ethyl xanthate collector. Aerofloat 208 is stated to be an effective promoter for the flotation of fine metallic gold; the 301 reagent is a secondary butyl xanthate which is a stronger promoter for most sulphides. Reagent 404, replaced by Aerofloat 208, is a good collector for auriferous pyrite ores, while the ethyl xanthate was the general sulphide collector.

A further reagent change was made at the lead cleaners. Reagent 620 was added to the pulp ahead of the first lead cleaner. This reagent exerts a strong slime dispersing action. It also acts as an iron sulphide depressant, thus rejecting a certain amount of this contaminant from the lead concentrate.

Coupled with the change to greater selectivity in the gold collector employed within the lead circuit, a Denver 66½ ball mill for regrinding flotation middling was added to the lead section. The three Marcy 77 ball mills in the primary grinding circuit produce a flotation feed that is 65 percent minus-325-mesh. This is an excellent grind, particularly for an ore that is hard and abrasive. In view of the fine grained nature of the ore, regrinding of the locked middling from lead rougher flotation produced obvious advantages in grade and recovery of lead concentrate. The regrind mill is in a closed circuit with a cyclone which returns a 96 percent minus-325 product to cleaner flotation.

By putting the cyanide plant on the lead tailing, any free gold and the gold locked in pyrite was subjected to treatment in a circuit that would yield maximum profit as a gold-silver precipitate. The cyanide plant is now tied to the regrind circuit in the lead section of the mill. The feed consists of the tailing from the middling flotation operation. The cyanide residues are returned to scavenger cells in the lead rougher circuit. This arrangement has the advantage of returning undissolved gold from the cyanide circuit back to the lead circuit where the pulp can be scavenged before it enters zinc flotation.

Improving Zinc Grade

Ferrous sulphate is added to the cyanide plant residues to help complex free cyanide. This is a critical point because a build-up of the

These Men Run The Iron King

D. M. Kentro	Assistant vice president and general manager.
E. Thomkinson	Mine superintendent.
T. L. Hoskins	Mill superintendent.
A. W. Jeffers	Chief metallurgist.
L. Bonbardieri	Chief engineer.
B. R. Waples	Design engineer.
J. G. MacGregor	Purchasing agent.
W. W. Richardson	Chief clerk.

Comparative Metallurgical Data Highlights Plant Changes

Today's Figures Reveal an Economic Recovery of 84.20%

Grade of Mill Products, December, 1958

Metal	Assay Heads	Lead Conc.	Zinc Conc.	Cyanide Ppt.	Tailing
Gold (oz./T.)	0.1308	0.9699	0.0953	188.243	0.0469
Silver (oz./T.)	3.73	32.12	3.78	1860.52	0.853
Lead (%)	3.05	33.76	1.45	—	0.29
Zinc (%)	9.05	9.48	55.77	—	1.36
Copper (%)	0.178	1.26	0.31	—	0.049

Metallurgical Recovery, December, 1958

Metal	Percent Recovery in Lead Conc.	Zinc Conc.	Cyanide Ppt.
Gold	57.8	9.5	4.3
Silver	67.2	13.2	1.5
Lead	86.2	6.2	—
Zinc	8.2	79.9	—
Copper	55.3	22.5	—

Three Years Ago Economic Recovery Was Only 66.14%

Grade of Mill Products, December, 1955

Metal	Assay Heads	Lead Conc.	Zinc Conc.	Cyanide Ppt.	Tailing
Gold (oz./T)	0.1384	0.7648	0.1094	223.726	0.0577
Silver (oz./T.)	4.22	27.51	6.24	3534.63	0.934
Lead (%)	2.83	21.99	1.69	—	0.54
Zinc (%)	7.73	9.10	51.43	—	2.03
Copper (%)	1.81	0.92	0.33	—	0.68

Metallurgical Recovery, December, 1955

Metal	Percent Recovery in Lead Conc.	Zinc Conc.	Cyanide Ppt.
Gold	56.0	8.0	2.8
Silver	66.0	14.9	1.5
Lead	78.7	6.0	—
Zinc	11.9	67.1	—
Copper	51.5	18.4	—

cyanide ion could act to depress zinc and cause high tailing losses in the zinc circuit. On the other hand, small amounts of free cyanide exert a beneficial effect in the zinc circuit by its depressant action on iron sulphides. This helps reduce the quantity of sodium cyanide fed to the zinc cells to gain the desired difference in floatibility of zinc sulphide and iron sulphide.

Reagents designed to increase the selectivity of flotation in the zinc sulphide circuit were added. Sodium Aerofloat, marketed by American Cyanamid, is now the primary promoter used in zinc flotation. It replaced an ethyl xanthate collector that had been used in the past. Production of a clean zinc concentrate is complicated by the intergrowth of sphalerite and iron sulphides. Sodium Aerofloat is widely known as a powerful zinc collector.

Alkalinity in the zinc circuit is critical and is determined by titration for free lime at least every hour. In the rougher circuit CaO content is maintained at 0.002 percent or under. In the zinc cleaners, the allowable free lime content is 0.03 percent CaO.

How Plant Operates

Product flow through the mill is as follows. The mill crushing plant receives a minus-3-inch feed from the mine delivered through a concrete-lined underground tunnel. The feed is reduced to minus-¾-inch by means of a Nordberg 4-foot shorthead crusher in closed circuit with a 5- by 8-foot Rod Deck screen. It is bedded in a series of interconnected silos that provide 1,900 tons total storage and 1,100 tons live storage.

Mill feed is ground in three identical Marcy mills; these are close circuited with Krebs 15-inch cyclones. The primary mills are fed with a rationed charge of 3- and 2-inch alloy steel balls.

Lead sulphide flotation is carried out on a pulp containing 25 percent solids using cresylic acid as a frother and the flotation reagents previously discussed. The pulp goes through nine rougher Fagergren cells. Froth from the first four is taken to a single-stage set of two cleaner cells. The final five roughers make a middling product for the regrind circuit and the rougher lead sulphide tailing reports for zinc flotation.

The Denver cells in the lead cleaner circuit make a finished lead concentrate, a recirculating load returned to the regrind ball mill, and a tailing for cyanide treatment. Approximately 150 tons per day of feed enter the cyanide plant.

Lead rougher tailing is conditioned with copper sulphate to activiate sphalerite, lime to depress iron sulphides, and the sphalerite floated using cresylic acid and Sodium Aerofloat. The froth from the Fagergren roughers in the zinc circuit is cleaned in two stages and pumped to the filter plant.

Filtration of the zinc concentrate had been a problem in the past because of the preferential tendency for sphalerite to grind to an extremely fine size. Before the new filter plant was built, the practice was to employ a drier on the filter cake. Today, moisture content of the zinc concentrate cake has been reduced 1.5 percent simply through the use of reagents fed to tank on the Eimco disc filter (see picture for details).

Metallurgy has certainly been a mine-maker at the Iron King. Under the distressed condition of the present metal market, the mine has continued to show a profit and has gradually expanded treatment capacity from 150 tons in 1942 to 750 tons in 1955 to the present 1,000 tons daily. Today, the mine is the fourth largest lead producer in the United States. Grade of lead concentrate has improved from an average of 20 to 25 percent to the present figure of over 32 percent. Recovery of lead in lead concentrate has risen from 70 percent to 85 percent. The grade of zinc concentrate has shown a steady upward trend from 50 percent to an average of 56 percent. Recovery of zinc in zinc concentrate has climbed steadily from 67 percent to almost 80 percent.

END

Clayton Silver

ROCKER SHOVEL loading from drawpoint raises on 500 level is fast; same system will be used for 800 stopes.

ELECTRICAL-MECHANICAL SKILL of mine manager R. J. Legard was required for power plants and pumps.

STATION PUMPS on 500 level are set on bulkhead over the top of the main sump which is cut in solid rock.

1. Uses an Air-Powered Eimco 630 in Flat

By mechanizing shrinkage stoping and maintaining an aggressive development program, Clayton Silver Mines has been able to continue operations at its silver-lead mine in Custer County, Idaho.

It hasn't been easy, with the recent low lead prices and the increasing pumping costs for this small deep mine; it would not be economically possible if it were not for the relatively large size of the main ore shoot and the simple mill flowsheet to recover a high percentage of metals in the ore.

By holding the total crew, including supervisory personnel, to between 23 and 26 men who mine and mill 100 tons of ore daily, and by continuing development, the company was able to show, in 1958, a net income of $1.31 per ton on ore from which was recovered 7.4 ounces of silver, 3.2 percent lead, and a very small amount of copper per ton. Net smelter income was $9.84 per ton.

The most important factor in achieving this has been low cost shrinkage stoping. Three miners and one powderman broke about 250 tons of ore per day in this stope, which is 35 feet wide and 200 to 250 feet long. With a good cushion of broken ore when the stope was completed to 400 level, the mine crew deepened the vertical shaft from the 500 level (550-foot depth) to the 800 (850-foot depth) and has driven more than 500 feet of drift north on the lower level. Another 800 feet must be driven to come under the projected location of three main ore shoots on the lower new level.

The mill crew of five men is constant, with three operators, one crusherman, and one repairman. So is the supervisory force of one manager, an assistant manager, and the mine foreman. The four- to six-man development crew drives one raise one shift and the four-man drift crew drives the 800 level two shifts. The production crew is composed of one hoistman, one mechanic, one skip tender, one grizzly man and two loader-trammers.

Three main ore shoots have been developed at Clayton. One relatively small, just south of the shaft; one small one just north of the shaft; and the much larger north shoot which rakes 45° north, away from the shaft. These ore bodies, elongated lenticular shaped, occur in the Clayton dolomite which is up to 500 feet thick and forms the east flank of a north-south striking anticline. The dolomite is intensely sheared over widths of 100 to 300 feet so that localization of miner-

2. Finds That It Is Cheaper To Run Mine

It costs money and takes a lot of electricity to pump water out of the Clayton mine. The mine makes between 900 and 1,000 gallons of water per minute. When the shaft was deepened from the 500- to 800-foot level, a heavy inflow of water was developed in the sump below the 800 level. As the exploration drift is extended north on this level, below the 500 workings, more water is developed. Inflow in late summer was 450 gallons per minute on the 500 and 550 on the 800. The increased inflow and higher pumping head on the 800 in comparison to the 500 requires an additional 160 horsepower. The Montana-Idaho earthquake on August 17 opened up a fault on 500 level and increased water inflow 300 gallons per minute. Additional pumping capacity is being installed.

Mine manager R. J. Legard, with many years of electrical experience at Sunshine Mining Company, knows the importance of maintaining a constant power load. This is especially important because power is supplied by three sources: Diesel electric generated by the company; from the company's hydroelectric plant; and purchased from the REA. Starting or stopping any of the three 60- or three 100-horsepower pump motors places a heavy demand on the system.

Therefore, all station pumps are operated continuously despite fluctuations in mine inflow or depth of water in the 100,000-gallon sump on 500 level. Of course this sump is kept pumped down to accommodate any sudden inflows such as occasionally develop when a round is blasted in north drift.

Water on the 800 is collected in a sump and pumped to the main 500 sump by three, 3GT Ingersoll-Rand, 60-horsepower, and two, Cameron

Shrinkage Stope to Bulldoze the Ore to Draw Raises

alization is favored by both fracturing and wall rock composition; fracturing is the most important. Siderite and quartz are gangue minerals; galena, sphalerite and minor tetrahedrite are ore minerals.

At times the ore is solid sulphide, but most commonly is sulphide filling in veinlets and replacement of dolomite. There are no continuous walls in the stopes and regular practice is to use assay walls and also to drill 10-foot deep test holes into the wall. Several high-grade lenses have been located in this manner, and the stope widened to mine them.

Rake, Dip, Complicate Mining

With the flat rake of 45° and the 70° dip of the ore body, it is impossible to shrink the big stope without driving some footwall raises in waste until they break through into ore. Normal practice is to drive these raises at 40-foot intervals for draw points. Every 100 feet, follow-up raises are established through the ore body for ventilation and service. These raises are located in the heart of the ore body so they normally are in ore their full height.

The footwall draw-raises are soon filled with broken muck as stope advances, so the main raises are most important. In the big stope, it is sometimes difficult to keep the main cribbed raises open; thus, when the stope is 65 percent completed, several raises are driven through pillar to level above.

Maintaining an even draw of broken muck in the stope is difficult, even with auxiliary footwall draw points, because ore hangs on the footwall. The 70° dip is steep enough for good cleaning, but the 45° rake is too flat. The result is that muck will draw down and funnel away from the hanging wall.

This immediately creates two problems. The first is that it is impossible to drill the back with Airleg machines, and second, the muck on footwall side is too close for drilling. Ore build-up on footwall also prevents close inspection for stringers, veinlets, fractures, etc., which must be followed or prospected in order not to leave any ore unmined in wall.

To level broken ore and clean footwall without additional men, the management decided to buy and use a new Eimco 630 air driven bulldozer.

Once the bulldozer was in the stope, it was carried on top of shrink through to 400 level. It was soon found that it took only one hour per shift to clean footwall and level muck to proper height for drilling next round. It was also found that the last hour of the shift was the best time for dozing because the miners were loading holes and air pressure was good. The bulldozer uses much air, and pressure could not be maintained while both drilling and dozing. With a little planning, it was always possible to park the dozer in a section of the stope far enough away from blasting so that it was never damaged.

Both back and breast stoping was done. Back holes, 8 feet deep, were drilled with Gardner-Denver 58 airlegs on 30- to 36-inch centers. Breast stoping from hanging to foot wall was in five-foot cuts with 10-foot-long steel.

Shrink muck is loaded from drawpoints with 12 B Eimco loaders into 2-ton side dump Coeur d'Alene cars. The loader operator loads and trams three-car trains to the skip pocket.

Norman M. Smith is general manager with headquarters in Wallace where he also directs Clayton's other mining interests. R. J. Legard is Clayton manager; R. S. Settles, assistant manager; and Junior Leuzinger, mine superintendent. They are all hard working supervisors, too, which adds materially to low cost mining.

Pumps Continuously for Top Efficiency

(20-horsepower) pumps in series.

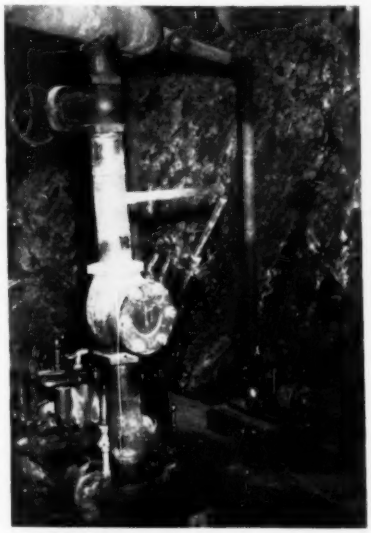
While the three 3GT Ingersoll-Rand, 100-horsepower pumps on the 500 level normally have a capacity in excess of the 900- to 1,000-gallon inflow to the main sump, only enough water is actually pumped out of the mine through the 8-inch column to maintain sump at low level. A 2-inch bypass line from this column leads through a Clay float valve to the sump.

Here's how this valve works. As water level rises, the valve is closed so all water is pumped up shaft. As sump level drops, the valve is opened to permit recycling of water from sump through pumps and back to sump. This is a positive action valve which is either open or closed. There is no valve flutter or sticking.

In addition to maintaining an empty sump, this system assures a steady pump load with no danger of loss of prime which can happen with frequent pump starts and stops. For more efficient pumping, the 800 level discharge line empties into a 6,000-gallon tank set alongside and just above the 800 level pumps. This assures a positive head into these pumps.

Each sump is equipped with a float switch which turns an alarm on and rings a bell in the mill and in two supervisors' houses on surface, when water level is either too high or too low. With this system, there is no need for anyone underground during the afternoon and graveyard shifts.

An unusual, simple and effective water jet ejector was used to dewater the shaft while sinking from 500 to 800. High pressure water from main pump column supplied the jet force to lift water out of shaft bottom; it discharged into 500 sump. The ejector was lowered with each round and handled shaft water with ease. END



BYPASS LINE from main pump discharge column leads to Clay valve which regulates water return to sump.

DMEA Project Blossoms into Best U.S. Mica Mine

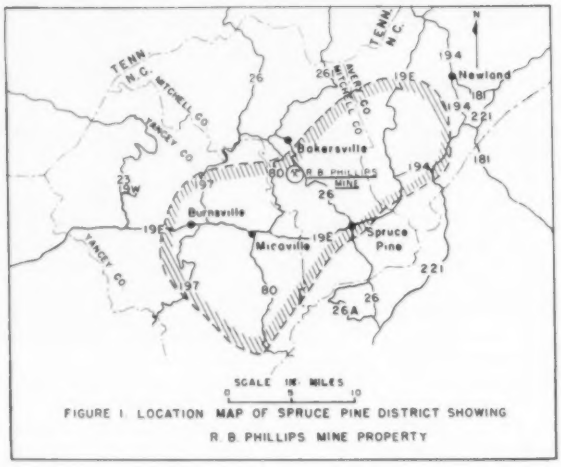


FIGURE 1. LOCATION MAP OF SPRUCE PINE DISTRICT SHOWING R. B. PHILLIPS MINE PROPERTY

These Were the Guides . . . . . .

Known but unexplored pegmatites may contain significant amounts of sheet mica.

Mica-rich shoots have the same attitude as major linear features of country rock.

Favorable areas are those underlain by hornblende gneiss and mica schist.

Drag-folded and faulted layers are logical places to search for blind pegmatites.

By Dewey H. Amos

A successful project for the exploration of strategic mica conducted under the Defense Minerals Exploration Administration program was completed by a partnership of Messrs. Zeb Buchanan and W. R. Johnson. It was done on a relatively unexplored pegmatite exposed on the R. B. Phillips property in the Spruce Pine district of western North Carolina.

Mining subsequent to and as a direct result of the exploration has yielded the largest production of strategic sheet mica from any single mine in the United States in recent years.

The R. B. Phillips mine is in Mitchell County near the central part of the northwestern margin of the Spruce Pine pegmatite district. The location of the mine is shown in Figure Nos. 1 and 2.

Mica In The Pegmatites

Muscovite generally constitutes two to eight percent of the pegmatite. In some, the individual crystals of muscovite when trimmed may be too small to yield commercial trimmed sheet mica. The minimum size acceptable must have an area of 1.0 square inch and a minimum one side dimension of at least three-fourths of an inch. In other bodies most of the muscovite is large enough to yield sheet mica. The crystals are generally larger in the thicker portions of a body than in the thinner parts.

Pegmatites within a limited area in the district commonly contain muscovite of the same prevailing color (Olson, 1944, pl. 2). Commercially, two colors are recognized, ruby (red rum), and nonruby (green, rum, light brown). Rarely are micas of two colors present in the same pegmatite. Those containing nonruby mica generally have a greater percent of potash feldspar and more sodic plagioclase than those that contain ruby mica. Pegmatites closely associated with alaskite invariably contain green muscovite.

What Makes Mica Commercial

The quality of sheet mica for commercial purposes depends largely on the amount of mineral inclusions (staining), air inclusions, the degree of flatness, and the color. Mineral inclusions occur intergrown with the muscovite or between cleavage planes. The most common minerals which occur as inclusions are biotite, quartz, magnetite, hematite, garnet, plagioclase, apatite, clay minerals and the alteration products of biotite, and the iron oxides. Stained muscovite is more prevalent in pegmatites which occur in the peripheral areas of the district, especially in bodies having alaskite or hornblende gneiss wall rock. Ruby muscovite is currently of more value than nonruby varieties of equivalent quality and size. Muscovite which does not split into flat cleavage surfaces cannot be fabricated and can be marketed only as scrap mica.

Curved cleavage surfaces result from post-pegmatite movement and are most common in bodies at the northeast and southwest ends of the district. Distortion of the muscovite by rock movement may also produce ruling of the crystals into many ribbon-like strips parallel to glide cleavages. If these strips are too narrow, sheet mica cannot be recovered.

Other features possessed by muscovite which greatly lower the value of "mine-run" mica are A-structure and wedge-structure. Such structures originated at the time of crystallization. A-structure refers to cleavage imperfections called reeves or ridges that intersect at an angle of about 60°. Such a feature is probably a twinning phenomenon. Crystals with A-structure which are thicker at one end than at the other are said to possess a wedge-structure. The presence of A- or wedge-structure greatly reduces the yield of sheet mica. Normally most of the muscovite in an individual body is of one habit, either it does or does not possess these structures. They are more common in green muscovite than in mica of other colors.

Favorable Exploration Target

Privately financed prospecting of the R. B. Phillips mine was undertaken in early 1954. Natural outcrops were enlarged by excavations, several

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This article was prepared in cooperation with the Defense Minerals Exploration Administration.

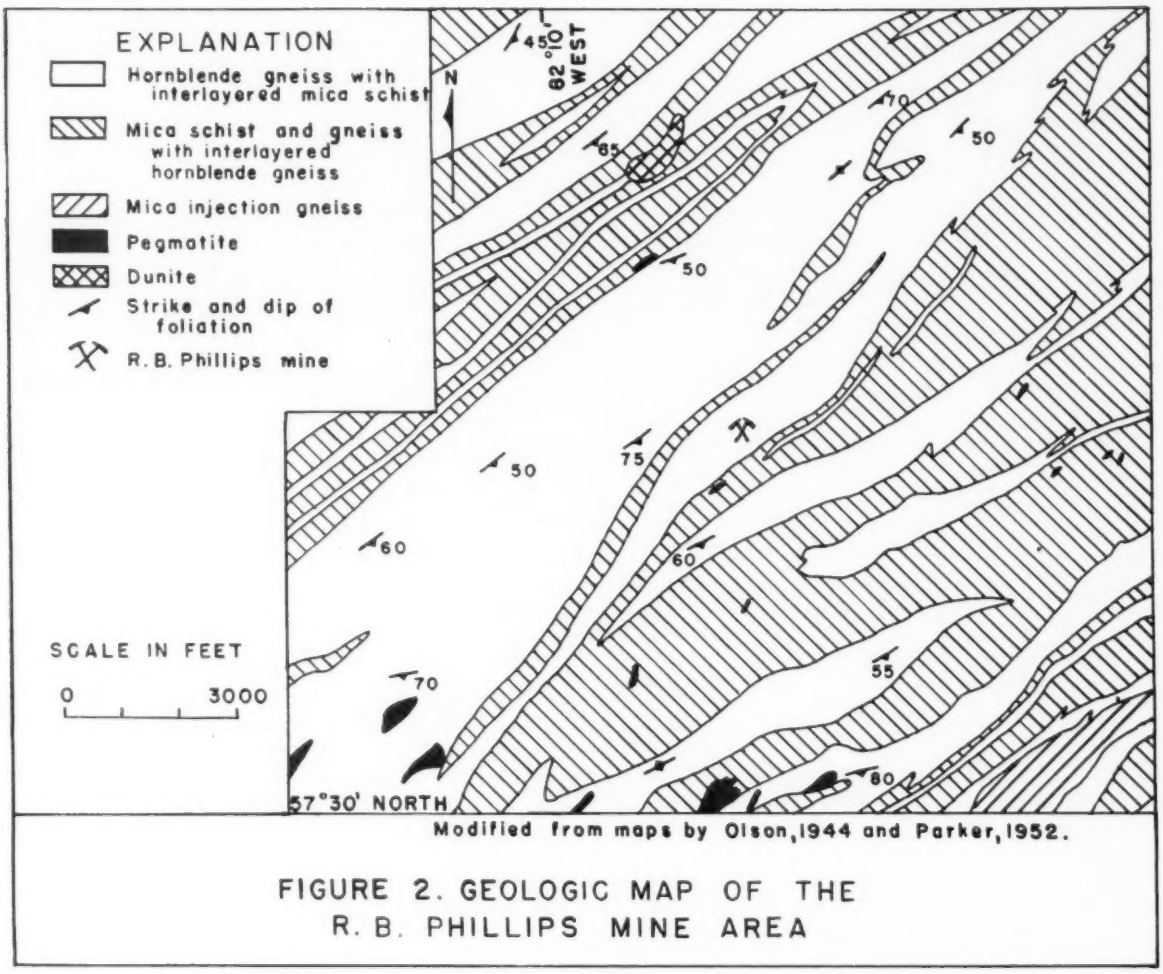

FIGURE 2. GEOLOGIC MAP OF THE R. B. PHILLIPS MINE AREA

shallow trenches and pits were made at places along the strike, and a 25-foot incline was sunk down the dip. These prospect openings and the outcrops gave discontinuous exposures for about 200 feet along the strike and showed that the width of the pegmatite ranged from four to six feet.

In July 1954 the operators obtained a lease on the prospect and applied to the Defense Minerals Exploration Administration for assistance in financing exploration. The application proposed that an exploratory incline be sunk and that exploratory drifts be driven from the bottom of the incline.

Field examiners of DMEA, after an inspection of the property and a study of the local geological features, recommended that financial assistance for exploration be granted. This recommendation was based largely on a consideration of the detailed local geology and on a knowledge of the characteristics of the sheet mica pegmatites of the district. Several features indicated the possible presence of a deposit of strategic sheet mica whose feasibility for mining could be determined at a very modest cost. Features which indicated that the pegmatite offered a favorable exploration target were:

1. Location of the pegmatite in one of the most favorable areas of the leading strategic mica district in the country.

2. Exposure along strike for about 200 feet, which probably indicated considerable continuity with depth.

3. Concordance with layering and foliation of the enclosing country rock. Concordant pegmatites generally have greater length, depth, and more regularity of shape than discordant bodies.

4. Presence of mica schist wall rock immediately adjacent to the body. Mica in pegmatites with hornblende-bearing wall rock is commonly badly stained.

5. Exposed thickness (four to six feet) of minable width. Such a thickness enables mining without the expense of blasting and handling large amounts of wall rock.

6. Presence of muscovite of excellent quality in the surficial exposures. Flatness of the cleavage surface, relative absence of mineral staining, and unusual thickness of the crystals normal to the basal cleavage indicated that processing losses would be much less than normal.

7. Mineral composition and texture identical to that of other pegmatites in the district which are large producers of sheet mica. Abundance of quartz and calcic oligoclase and the almost complete absence of potash feldspar is characteristic of the major sheet mica-producing bodies of the district. The absence of mineralogical or textural zoning, other than a very thin border zone (Cameron and others, 1949, p. 24) of fine-grained pegmatite, indicated that the entire width of the body might be productive and that selective mining of certain zones would not have to be undertaken in any thick portions of the body.

8. Lack of any evidence of post-

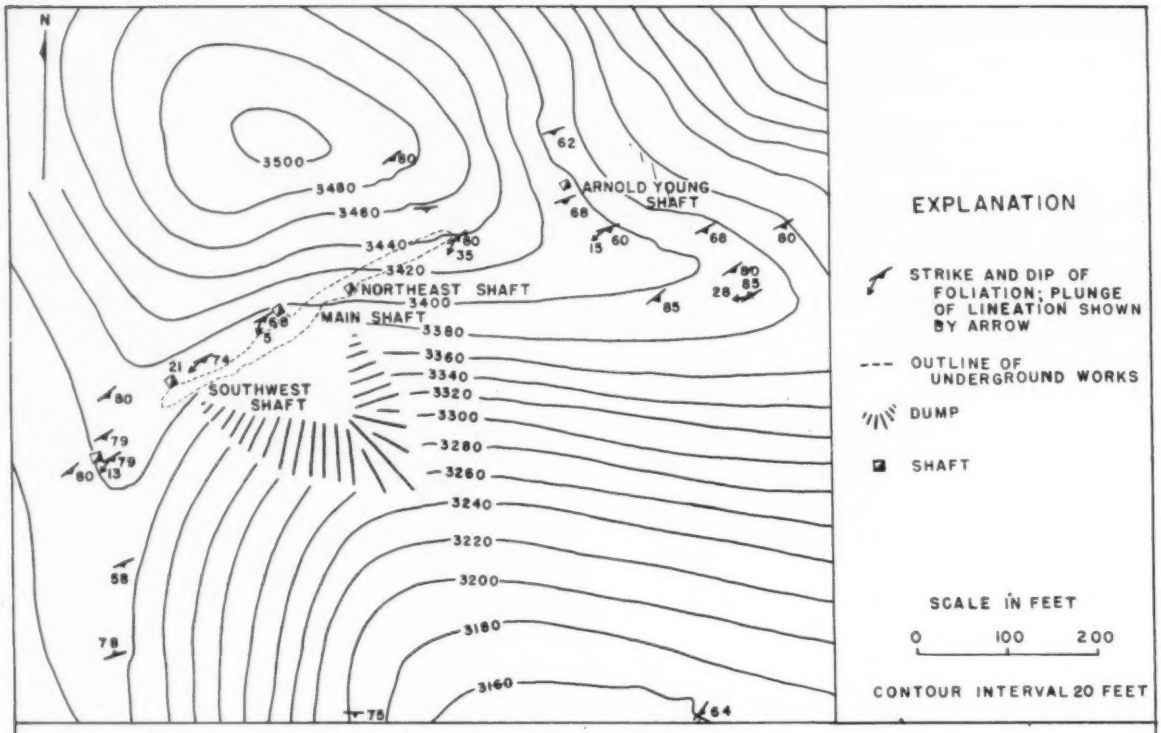

FIGURE 3. MAP OF R. B. PHILLIPS MINE AREA

pegmatite deformation and faulting. Such deformation and faulting is responsible for curved cleavage surfaces and ribboned (ruled) mica. In addition, the extent at depth of some pegmatites is limited by faults which may displace part of the bodies.

Alternative methods of exploration were considered but were rejected in favor of driving underground openings on the pegmatite as proposed in the application. In any appraisal of an untested pegmatite for its sheet mica value, bulk samples of "mine-run" mica are required to determine quality and processing characteristics. The necessity of determining quality as a part of exploration precluded exploratory drilling which would give little indication of quality. Omission of the incline and substitution of an adit which could be driven in a northwest direction from the steep slope southeast of the pegmatite was considered (figure No. 3). Such an adit would not permit a three dimensional sampling of the body. This sampling was regarded as very important, as the attitude of the linear features of the country rock suggested that any shoots or thickened portions would probably have very small angles of rake. The possible presence of mica-rich shoots could be most effectively investigated by an exploratory incline down the dip of the body.

Exploration Yielded Profit

Work under the DMEA contract began on October 25, 1954 and was completed on April 29, 1955. It consisted of extending the existing 25-foot incline an additional 40 feet and driving a total of 60 feet of drifts from the bottom of the incline. The incline, 5 by 12 feet in cross section, was sunk with the long dimension parallel to the strike of the pegmatite; drifts were driven 5 by 7 feet in cross section. The openings were confined entirely to pegmatite where possible. Hoisting of broken rock was done with a temporary boom and straight leg. Timbering was not required in any of the underground openings and it was necessary to pump only about 500 gallons of water per day. The exploratory work was accomplished with a crew of four to five men (two to three underground) working one shift per day. Work was curtailed during parts of the winter season. As considerable mica could be recovered while driving exploratory openings, the advance per shift was purposely slowed in order to prevent damage to the muscovite by blasting.

The DMEA contract specified that the operator was to accomplish the incline sinking at a cost of $45.00 per foot and the drifting at a cost of $35.00 per foot. The government reimbursed the operators for 75 percent of this cost. The government's contribution was to be repaid as royalty from production at a rate of 5.0 percent of gross sales if the exploration resulted in a discovery.

During exploration, mica was recovered as the openings were advanced and was processed and sold in small lots in order to determine quantity and quality distribution. The mica recovered from the exploratory work (about 12,000 pounds of "mine-run" mica) had a value, when processed, in excess of $25,000: thus, exploration alone actually yielded a considerable profit.

After completion of the exploration contract, mining operations were undertaken. The exploratory drifts were extended and stoping was conducted from the drift level. Underhand stoping (by benching) and overhand stoping were conducted simultaneously (see Figure Nos. 4 and 5). Concurrent use of underhand and overhand stoping is possible because all

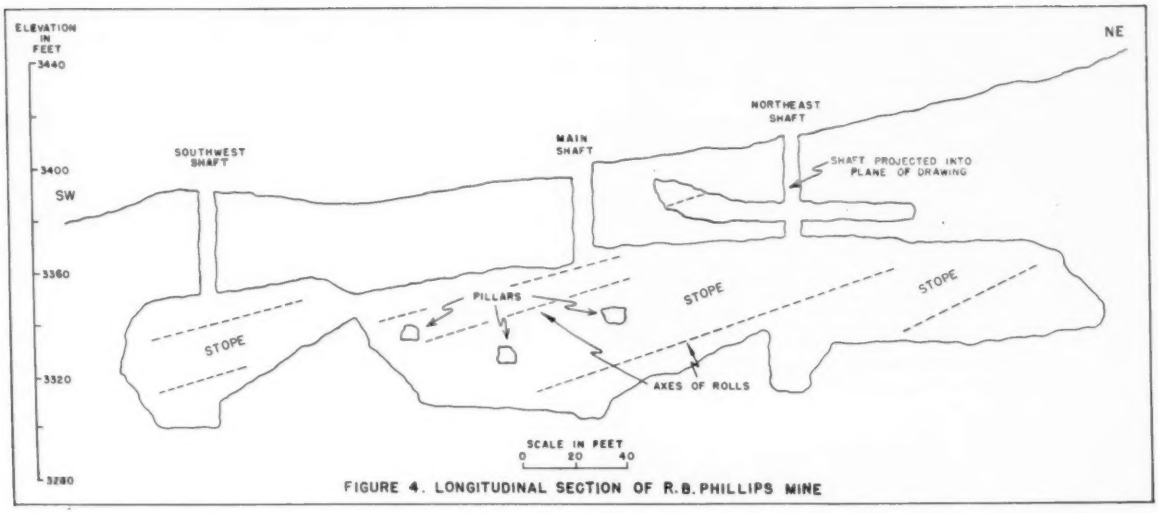

FIGURE 4. LONGITUDINAL SECTION OF R.B. PHILLIPS MINE

broken rock is moved to the surface in order to separate the mica by hand. The entire pegmatite, except for pillars, is stoped. The minimum stope width possible is about four feet; where the pegmatite is less than this width adjacent wall rock is removed, preferably from the footwall. An irregular pattern of pillars is left for support; normally these are in areas of mica-poor pegmatite.

Two additional shafts have been sunk northeast and southwest of the exploratory incline (Figure No. 3) to improve ventilation and to facilitate handling of broken rock.

Mining operations have been conducted continuously since completion of the work done under the DMEA contract. Operations have been on a one-shift basis with five or six men, including two surface workers. A total of 737,555 pounds of "mine-run" mica having a value of $678,694 was recovered to June 1, 1958 from the exploratory work and from the subsequent mining. A breakdown of the amount of each type of mica produced in this period is shown in Table No. 1.

The sheet and hand-cobbed production were sold to the local United States government Mica Purchase Depot and the punch and scrap mica was disposed of through local commercial outlets. The quality and size of the sheet mica production sold as full-trimmed mica are given in Table No. II.

During this same period about 53 percent of the trimmed sheet mica produced from the Spruce Pine district was a "good stained" and "better" quality and about 39 percent was of "stained" grade. Also, about one percent of all trimmed sheet mica in this period was No. 3 and larger in size and approximately 15 percent was No. 4 and No. 5 in size.

A breakdown of the qualities of the hand-cobbed mica ofter processing by the government is given in Table No. III.

Table No. I

Phillips Mine Mica Production by Types[1]

Type	*Number of Pounds*
Sheet, full trimmed	21,426
Hand cobbed	406,915
Punch	41,899
Scrap	267,315
TOTAL	737,555

1. The sheet, punch, and scrap mica obtained from the processing of the hand-cobbed mica is not included, as complete figures are not available.

Geologic Results

The country rock at the mine is largely thinly layered hornblende

Table No. III

Quality of Full-Trimmed Mica Processed from Hand-Cobbed Mica Mined at R. B. Phillips Mine

Quality	*Percent* 3-Quality Program	2-Quality Program
Good stained and better	53.2	81.9
Stained	33.3	18.1
Heavy stained	13.5	N.A.

N.A. Not available.

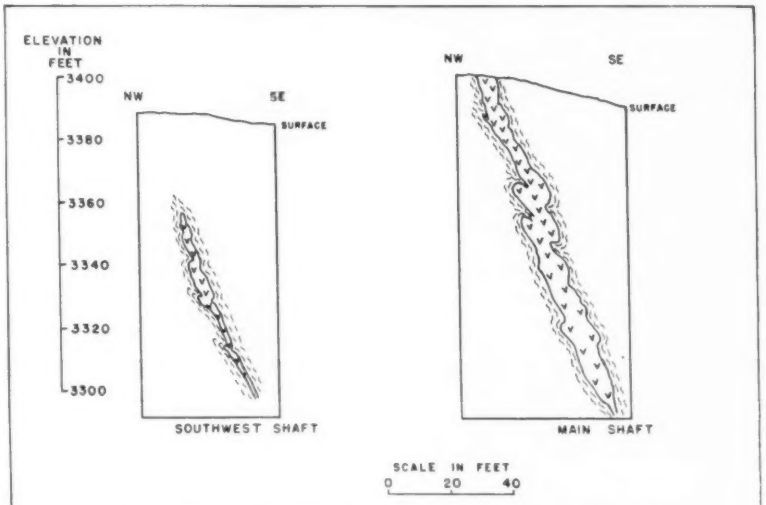

FIGURE 5. CROSS SECTIONS OF R.B. PHILLIPS PEGMATITE

Table No. II

Quality and Size of Sheet Mica Sold as Full-Trimmed Mica from R. B. Phillips Mine

Quality	Grade: Number 3 and Larger, Percent	Grade: Numbers 4 and 5, Percent	Grade: Numbers 5½ and 6, Percent	Total Percent
Good stained and better	0.3	10.9	57.9	69.1
Stained	0.1	3.1	21.7	24.9
Heavy stained	0.0	0.2	5.8	6.0

Grade	Area of Minimum Rectangle, Square Inches	Minimum Side Dimension, Inches
No. 6	1	¾
No. 5½	2¼	⅞
No. 5	3	1
No. 4	6	1½
No. 3 and larger	10	2

gneiss (Figure No. 2). Thin bands of mica schist and gneiss are interlayered with the hornblende-bearing rock. A layer of mica schist about 18 inches wide occurs along both walls. It is coarser grained than rock of similar mineralogical composition in the area which is not in direct contact with any pegmatite body. Foliation, generally well developed, is parallel to the layering which strikes N. 55 to 60° E. and dips 65 to 80° southeast. Several linear features are persistent in the country rock of the area. Most common are parallelism of the axes of minor folds, parallelism of axes of crinkles on foliation planes, orientation of the long direction of quartz pods, and orientation of the long dimension of certain mineral grains, especially hornblende. The more pronounced linear features plunge at low angles (15 to 35°) to the southwest. Locally, poorly developed lineation which plunges at high angles (60 to 75°) to the southwest occurs associated with the prominent gently plunging linear features.

Sharp contacts which are not frozen occur between the pegmatite body and the wall rock. Thickness of the body ranges from about six inches to approximately 20 feet. The thicker portions ("rolls") are cigar-shaped and plunge at low angles (12 to 20°) to the southwest (Figure Nos. 4 and 5). They are parallel to the main lineation of the enclosing country rock. At least five prominent "rolls" and two poorly-developed ones are recognizable in the present underground openings. All tend to pitch out down the long axis about 100 feet from the surface.

The body has a medium-grained pegmatitic texture (grains one to four inches in longest dimension) which is of a uniform character except for a thin, fine-grained border zone along both walls. Thicker portions tend to be slightly coarser grained than the remainder. Oligoclase (An_{25-28}), quartz, muscovite, and microcline-perthite are the main mineral constituents. Oligoclase constitutes about 55 to 70 percent; quartz, 20 to 30 percent; and muscovite, two to eight percent. Sparse amounts of apatite, garnet (probably almandite), and greenish sericite occur rather uniformly disseminated throughout all of the body except in the border zone.

The muscovite is green and relatively free from mineral inclusions; most of the books are flat. Individual crystals are much thicker than those normally present in the other pegmatites of the district; the dimension normal to the basal cleavage is often equal to or greater than the diameter measured parallel to the cleavage. A- and wedge-structure are not present. Some muscovite in the southwestern end of the main stope (Figure No. 4) is ruled and some has curved cleavage surfaces which indicates that it has, in part, undergone post-pegmatite deformation. Crystals tend to be oriented especially in thin parts of the body, where the basal cleavage is normal to the contact. Muscovite is much larger and slightly more abundant (four to eight percent) in the "rolls" than elsewhere in the pegmatite (two to six percent). A little more than one-half of the mica in the body between the "rolls" is too small to yield sheet mica when trimmed. Even though mica of sheet quality and size shows a marked concentration in the "rolls," the remainder of the body also contains mica of economic value.

Drag-type folds occur in the mica schist adjacent to the larger "rolls" of the pegmatite. (Figure No. 5). Small inclusions and thin septae of the wall rock are present in the pegmatite near such folds. The thickness of the "rolls" and of the drag-type folds have been accentuated by post-pegmatite shearing. These displacements are parallel to the strike but dip at a lower angle (about 45°) than the body. Only minor ruling and deformation of the mica near the shearing is evident.

The presence of sharp contacts which are not frozen suggests that the pegmatite body may have been emplaced along a fault. This is further indicated by the drag-type folds present in the wall rock. Orientation of the folds suggests a gravity-type displacement along the fault. The thicker portions "rolls" probably represent filling of the larger openings formed by movement along an irregularly curved fault plane. Consistent parallelism of the long axes of the "rolls" and the major linear features of the country rock suggests both are a result of the same forces. As the orientation of the drag-type folds denotes tensional stresses, the faulting apparently occurred during relaxation of the forces responsible for the major lineations present in the country rock. The pegmatite was probably emplaced during the period of faulting. The similarity of the R. B. Phillips pegmatite to many others in the north-central part of the Spruce Pine district suggest that most were emplaced along faults. Such faulting was apparently restricted chiefly to the less competent mica schist and gneiss interlayered with the hornblende gneiss country rock and explains the presence of mica-bearing wall rock along most of the pegmatites of the district which occur in metamorphic rocks.

END

Acknowledgments

The writer is grateful to Messrs. Zeb Buchanan and W. R. Johnson, operators of the R. P. Phillips mine for permission to use production data published in this paper. Thanks are due to Mr. Victor J. Lynch, U. S. Bureau of Mines member of the DMEA field team, Region V, and to the following persons associated with DMEA who contributed to the mapping and the accumulation of geologic data: Messrs. Kefton H. Teague, Lawrence E. Shirley, Frank G. Lesure, Sheldon C. Bergman, Alfred R. Taylor, Stanley Feitler, and Juan Pilac.

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Agglomeration Tests Start at A-C Plant

Multi-ton samples of ore from all over the world are now being treated in Allis-Chalmers' pilot plant at Carrollville, Wisconsin.

This plant is being used:

1) To demonstrate the feasibility of agglomeration (pelletizing) processes for a wide range of raw materials.
2) To determine variations in operating conditions.
3) To develop and study techniques required for handling, preparing, and processing the test materials.

This plant is designed to completely and flexibly duplicate full-scale materials handling; filtering and blending of wet raw materials; feeding of wet or dry raw materials; weighing; product cooling (heat recovery); proportioning of additives; and balling (pelletizing) the materials prior to processing in the combination of traveling chain-type grate and short rotary kiln. Extensive operational and process information is recorded for examination and interpretation by engineers of both Allis-Chalmers and the company seeking to process a material.

Priority On Iron Ore Tests

Iron ore agglomeration processes testing presently falls into three categories:

First, processes have been developed to agglomerate and heat treat magnetite and hematite concentrates produced from low grade iron ores. The product is extremely hard, durable pellets ideally suited for blast furnace feed. In addition, the processes offer the steel and ore mining industries important economies in fuel (approximately 750,000 Btu's per net ton for magnetite), with operating and maintenance costs expected to be considerably below any other process achieving this excellent fuel efficiency. These processes have been successfully demonstrated on a variety of ores from all parts of the United States, Canada, and South America.

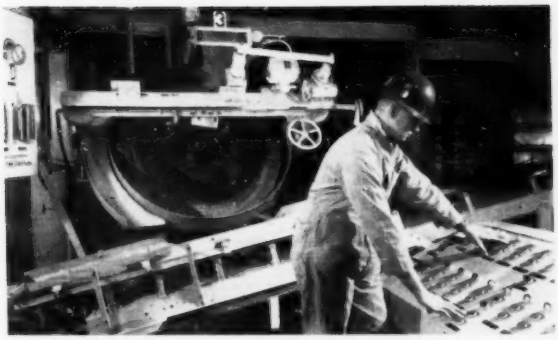
A second important consideration is the pelletizing of natural fine iron ores. Initial pilot plant work indicated that, with modification, the system can be used to carry out agglomeration processes for ores such as those found in Michigan and South America. As with the processing of magnetite and hematite concentrates, fuel efficiency, system economy, and product superiority are attractive.

Finally, as more low-grade iron ore is used, magnetic roasting of hematite to magnetite with subsequent magnetic concentration increases in importance.

After concentration, iron content will average 60 to 65 percent compared with present 50 to 52 percent ores. Indications are that it is feasible to roast certain types of hematite to magnetite, permitting the more economical method of magnetic concentration.

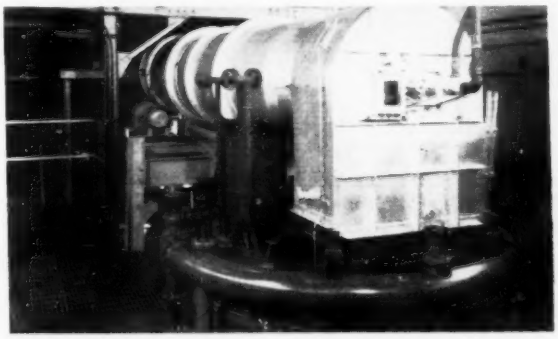
Phosphate Pellets Show Promise

Preparation of phosphate rock pellets suitable for shipment to electric arc furnaces has been satisfactorily demonstrated in *Grate-Kiln* equipment. Hard, durable phosphate pellets of this type would aid production of elemental phosphorus by giving the furnace operator a uniformly sized feed of high porosity condusive to rapid reduction.

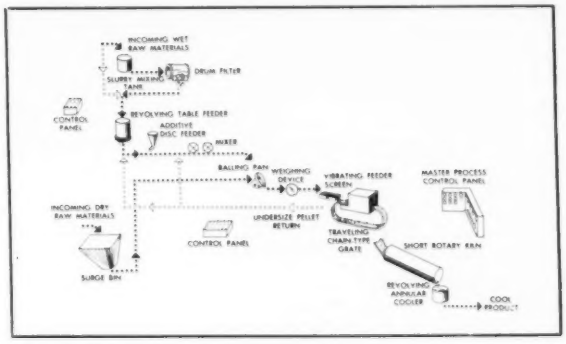


INSTANTANEOUS CHANGES in speed, slope, and feed rate to balling pan are made to produce pellets of desired size.

TRAVELING GRATE dries and preheats pellets. This is updraft with separate wind boxes for drying and pre-heating.



ROTARY KILN gives facial heat treatment to preheated pellets. Fired pellets drop into annular cooler to recover sensible heat.



PILOT PLANT is set up to test either wet or dry materials. Master process control panel records all data.

REGULAR PRODUCTION UNITS dominate the mining equipment exhibition in London. All types of underground machinery were displayed for the benefit of engineers from all parts of the world. Many of the smaller pieces were shown on the balconies.

From Olympia, London—

Highlights of machinery exhibits with symposium on tunnelling and shaft sinking

E. R. Borcherdt, manager of mining research for The Anaconda Company, attended the recent International Symposium on Shaft Sinking and Tunnelling at Olympia, London, England, held in connection with the outstanding machinery exhibit of the Council of Underground Machinery Manufacturers.

Mr. Borcherdt has written this summary giving his views of the technical program and the machinery show especially for MINING WORLD *readers.*

The Symposium was attended by 500 to 600 engineers from various countries of the world; 25 papers were presented. Authors were Russian, French, German, Polish, South African, English, American, Hungarian, and Czechoslovakian so that simultaneous interpretation with headphones was necessary.

Perfect timing was required in order to present 25 papers in three days of sessions. In order to achieve this, prepublication of the complete papers placed the papers in the hands of those planning on attending the Symposium, a month or six weeks in advance of the meeting. Allotment of time to the authors of 10 minutes for the condensed review of the paper and 10 minutes for discussion was faithfully adhered to.

It seems to me that something on this order will be necessary for both the American Institute of Mining, Metallurgical, and Petroleum Engineers and the American Mining Congress meetings to avoid two common interest papers being presented at the same time.

Three papers were particularly outstanding:

Shaft Sinking Practice in South Africa, by H. McConochie, of the Anglo-American Corporation of South Africa Ltd.

The History of Cementation in Shaft Sinking, by F. G. Atherton and W. F. Garrett. The Cementation Company Ltd.

Shaft Raising and Sinking in Sweden, by Victor F. Epstein of L. K. A. B. Sweden.

Each has been abstracted by the MINING WORLD staff and follows.

There were several highly theoretical papers by college professors which were not of much interest, and a number of papers dealing with coal mining and special conditions encountered in sinking coal mining shafts in various European countries.

The machinery show, which was carried on simultaneously with the Symposium, was largely an exhibit of British and European coal mining equipment. The Alimak Verken exhibit showing one of the latest raise driving and climbing machines was the most popular exhibit for South African, United States, and Canadian mining engineers. The September 1959 issue of MINING WORLD carried a complete article on this new raising machine.

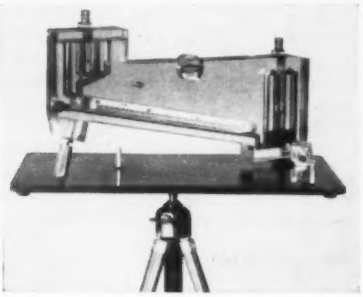
Some of the coal mining equipment for the support of the long wall operations, with centralized hydraulic control, might be adaptable to uranium mining operations in Utah.

Equipment which should be of particular interest to United States mining companies is pictured and described in this section.

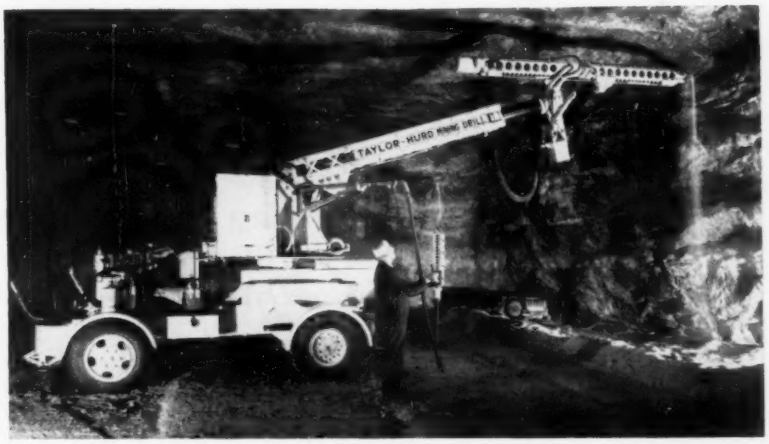
London Machinery Exhibit Featured This New Equipment

Super Sensitive Manometer

Combustion Instruments featured its new Mark 4 manometer which easily measures pressure differences as small as 0.005-inch water gauge. This gauge is mounted within a solid block of transparent Perspex making it so rugged that if the instrument is dropped it can readily be picked up, releveled, and used as before.



The tripod-mounted unit is the inclined-tube, liquid-column type equipped with non-spill construction. When packed flat in its tripod fitting baseboard the instrument fits into easy-carrying case with the total weight of only 3.5 pounds. Please circle No. 72 for further details of this important ventilation survey instrument.

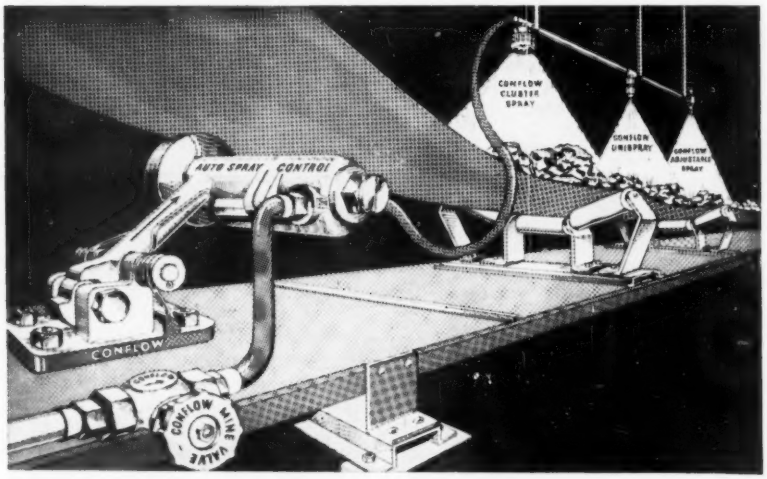


Electric Rotary Drill Uses Self-Collaring Guide

F. Taylor & Sons Ltd. displayed the newest production model of its Mobile Mining Drill which actually was in process of delivery to United Steel Company Ltd's. iron ore mine in Lincolnshire.

Press-button actuated hydraulic controls permit boom positioning to drill holes at any point of a 24-foot-wide and 18-foot-high face. The electric powered drill advances the 1 11/16-inch bit at speeds to four feet per minute. The drill rod is totally enclosed within octagonal frame and is built with two guides. The front guide rotates at the same speed as the drill rod and is close to the rod end so that the drill is self collaring; even on a very jagged face.

Also shown was a Diesel propelled multiple purpose truck equipped with a hydraulically actuated platform which can be raised to a height of 18 feet. This unit is used for loading holes, roof bolting, and high scaling. The platform can be moved from controls on platform itself. The Diesel engine can also be operated from controls on platform. Circle PEP No. 74 for full information on these pieces of equipment.

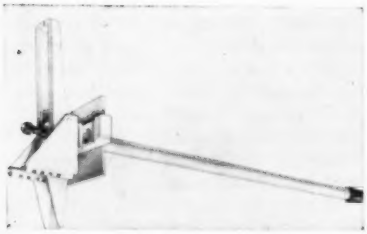


Automatic Spray Control For Moving Belts

Conflow, Ltd. exhibited its fully automatic, non-manual coveyor belt driven system for spray dampening and dust suppression of ores transported by conveyor belts. Controlled moistening before agglomeration or briquetting as well as complete quenching of conveyed loads is also possible

Conflow equipment permits water or other liquids to be sprayed on the conveyed loads only when they are moving; not when belt is stationary or belt is running empty. Get full information on this system by circling **No. 73.**

Recoverable Roof Bolt



Dowty Mining Equipment Limited exhibited its recently developed recoverable roof bolt which can be reused indefinitely. It fits any 1 11/16 inch hole and a pre-stressing wedge assures immediate acceptance of load.

The patented synthetic-rubber gripping head expands as the bolt is tightened to make close contact with the walls of the hole. Loads varying from three to 10 tons depending on rock can be withstood. The bolt is released and withdrawn by pulling the handle from the bottom into a horizontal position using a chain or rope from a safe distance. This decompresses the gripping head. Continued pulling withdraws the bolt. Circle PEP No. 76 for further information.

From London Symposium

Pre-Cementation of Formations

It's usually the least expensive way for sinking through most water bearing strata

By F. G. Atherton and W. S. Garrett

Cementation to seal off water inflow into a shaft is now 95 years old, but the greatest use of cementation and advancement of the methods for pre-cementation in shaft sinking has been made in the last 20 years. Much of this has been done in the Union of South Africa where all the new deep gold mine shafts pierce water-bearing lavas and sedimentary rocks. Particularly troublesome have been the water filled caverns and fissures in the dolomite. The fissures are filled with soft muddy manganese wad or clay, neither of which have any inherent strength and flow freely under pressure.

Drilling Techniques

Drilling and injection techniques developed for cementing cavernous dolomites have been so successful that they are, with appropriate modifications to suit rock conditions, used in all South African shafts. It is now common practice to put down deep diamond drill holes ahead of sinking if water is suspected. A safe mounting for the drill has been developed which will control the drill rods when high pressure water is struck and by tightening up the stuffing box will prevent any leakage of water.

Rods can be removed from the hole by hydraulically controlled extractors which give full control. Pre-cementing this pilot hole often helps stabilize rock for closer drilling.

Immediately ahead of sinking, enough holes are drilled around, outside the shaft, and well ahead of the bottom to probe the area and tap any water ahead of sinking. Normally these are drilled to a depth of 160 feet using 2-inch tungsten carbide bits and 10-foot sectional steel. Sixteen holes have been found to give good coverage. It takes about eight hours to drill the 2,560 feet of hole.

Mr. Atherton is a director of Cementation Co., Ltd., and Mr. Garrett is managing director of Cementation Co. (Africa) Pty., Ltd.

Special precautions are necessary to control any quantity of water at any pressure which might be tapped by such a hole. A 2-inch-diameter steam pipe casing, never less than 5 feet long, is grouted into the collar of the hole using an accelerator for rapid setting cement. A specially strengthened valve is set on top of each casing and all drill rods are passed through it. The valve is fastened into rock with anchor bolts. If water is struck, the rods are pulled and valve closed to prevent any inflow. This is all right in theory, but at times the steel gets jammed and the valve cannot be closed. It is then necessary to cut it off with a torch or pull it free with main surface hoist so that the valve can be closed. Meanwhile, the shaft is flooding, and it becomes most difficult to close the valve. To overcome this problem, a new remote control valve, capable of resisting a pressure of 6,000 pounds per square inch, has been developed.

More often the water pressure violently ejects the drill string and it is shot up the shaft. Almost invariably in such cases the hole is left free and the valve can be closed.

Cementation Treatment

Once water has been encountered, the object is to convert the water logged area into a homogeneous mass which will resist the full hydrostatic pressure, withstand blasting during sinking operations, and remain stable long enough to permit the construction of the concrete shaft lining which forms the final and permanent water seal. Grout, of varying composition, is pumped into the rock through the drill holes. The most common and cheapest grout is a three sand and one cement mixture made on the surface and dropped through a 1½-inch pipe line to shaft bottom. The sand must conform to rigid size specifications; water-to-cement ratio is kept as low as possible. Under high pressure, the grout can be pumped to 5,000 feet before emplacement. The difficulties of grouting are apparent when it is remembered that it took 32 tons per foot of shaft, 18.5 tons of which was cement, to sink the West Driefontein Gold Mining Company's No. 3 shaft through 2,943 feet of dolomite. Injection holes required 155,000 feet of drilling.

A filler which has found much favor of late is finely ground basic slag which itself has setting properties when mixed with cement or lime.

Bentonite Grouting

At the new Monktonhall coal mine at East Lothian, England, the two shafts were sunk through areas where mining of coal seams had been conducted. Some of these seams were waterlogged, others dry, still others caved, and others open. It was necessary to consolidate all to protect shafts against water inflow and ground movement. A sand-cement grout was first used to seal these seams. In some areas the space was not adequately sealed and sinking was bothered by water inflow. A cement-bentonite (7.0 to 10.0 percent cement by weight) grout was tried. It sealed all the open cavities satisfactorily because the water content of mix was kept at an absolute minimum so that the grout had an angle of repose of more than 30°, yet remained pumpable. After thorough mixing, this grout retains its water, and unless violently agitated, does not readily absorb additional water. Therefore, it can be pumped into or through water without being diluted.

Chemical Grouting

AM-9, American Cyanamid's new chemical grout is coming into fairly wide mining use in the United States and is only now being introduced in Europe.

Chemical grouting has not had a wide field of application because the chemicals are expensive. The situation is now changing because of the developments in the plastic industry which make available a wide range of new and interesting substances. It is not unlikely that the next advance in injection technique will be along these lines.

Sweden Discloses Two Developments at London Symposium

Platform Sinker, Longhole Raising

By V. S. Epstein

Swedish mining engineers are now making a concentrated effort to overcome the problems of raising with long holes. The basic principle of doing all the drilling from either the top or the bottom of the raise is not new; however, better methods must be developed to keep the holes parallel with the direction of the raise and prevent deviation between the holes.

The general plan is to drill one or more large diameter holes, 3.5 to 6.0 inches, for the cut or break to hole. A series of smaller diameter holes are drilled around these holes to shape the raise.

As a hole guide, at the raise site, it is practical to pour a concrete slab through which a number of steel tubes are cast in place. The 12- to 16-inch-long tubes are carefully aligned before the concrete is poured so that they assist in directing the course of the hole. Thus, the miner has help in directing and keeping the hole in line while he drills it.

Diamond drilling has been used very successfully, but present efforts are largely based on percussion drilling because it is believed to offer cost advantages.

Raises from 125 to 140 feet high have been drilled and blasted without too much trouble, using a 6-inch machine with extension steel. Drill rods with a 4-inch bit for the large, empty, cut hole and 2-inch bits for the blast holes are used.

Normally, the bottom 40 to 55 feet are blasted in serial rounds from the lower level; then the remaining section is loaded from the top and successively blasted in 6- to 14-foot rounds. The blasting charge is placed using a line dropped into hole from the upper level. Great care must be used in positioning these charges in the hole and blasting them in proper sequence.

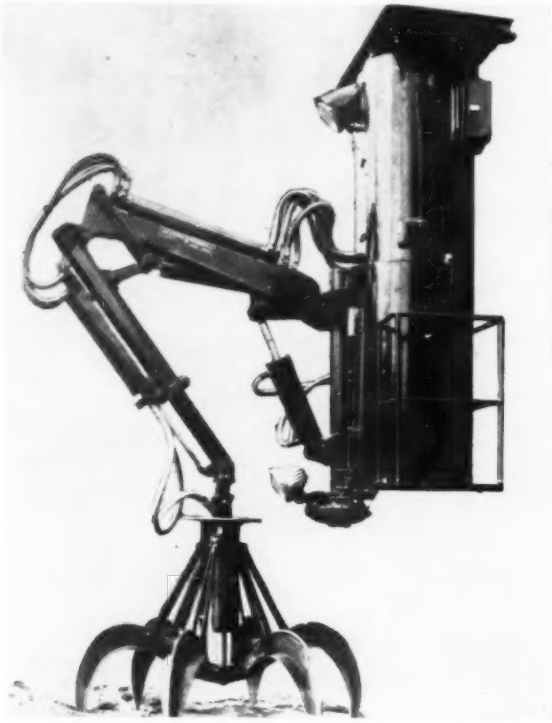
Swedish shafts are usually of small size and shallow depth, so very often a small shaft is initially sunk in developing a mine and a large raise then driven to serve for main shaft.

Dynamite cartridges up to 48 inches long and pneumatic powder loading machines are used to increase speed and efficiency of shaft sinking.

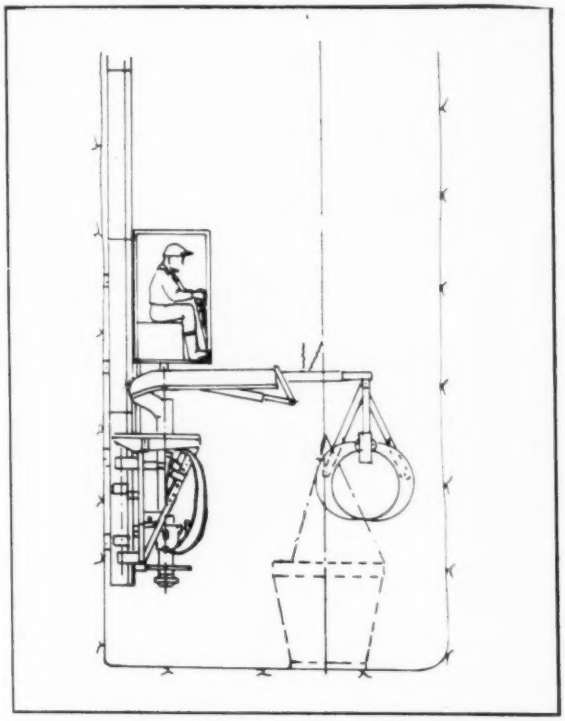
At Kiruna an elliptical shaft with an area of 11 square meters has been sunk using the Alimak BK sinking platform and cactus grab. The same type of guides bolted to the shaft wall are used to position and support the platform and grab as are used in the similar raise climber, decribed in MINING WORLD, September 1959, pages 52, 53, and 54. Initial goal was 1.2 feet of shaft per man shift. Broken rock is loaded into buckets and independently hoisted to the surface. Drilling is done from a frame jumbo which is built so that one miner operates two machines. A standard hole pattern has been developed to break seven feet per round.

Initial shaft sinking at Kiruna with this equipment has been successful.

Chief of mine planning section, development department of Luossavaara Kiirunavaara Aktiebolag, Kiruna Sweden



HYDRAULICALLY CONTROLLED grab at Kiruna was first built by the Swedish firm of Alimak-Verken AB., Skelleftea.



ALIMAK SHAFT SINKER is operated by one man who controls both loading and positioning of the unit on guide rail.

From London Symposium

South Africans point for–

1,000 Feet of Shaft per Month

By H. MacConachie

In South Africa we look forward to the day when a sinking footage of 1,000 feet per month will be attained and accepted as normal.

It is well known to mining engineers that today's record is tomorrow's standard. The record footage is now 834 feet of sinking and concrete lining the 27.5 foot diameter round No. 2 shaft of Free State Saaiplaas Gold Mining Company, Limited and was made in September 1958.

Most South African shafts are large, circular, concrete lined, from 18 to 28 feet in diameter, and are designed to hoist a minimum of 100,000 tons of ore monthly and pass a minimum of 800,000 cubic feet of ventilating air per minute.

Complete mechanization and simultaneous mucking and/or drilling with concrete lining is necessary to achieve such speeds. The 79-foot long sinking stage illustrated here has been developed for deep shafts. It is suspended on eight 1⅜ inch diameter ropes and never leaves the shaft once sinking is well underway. At 4,000 foot depth the total weight of stage, cactus mucking grab, men, wire rope, etc. is 224,000 pounds. The stage is built with four holes completely through it for passage of sinking buckets. The eight supporting ropes are positioned so that they act as guides for the four crossheads guiding the sinking buckets.

Normal practice is to pour 30 feet of lining at one time keeping the shaft bottom 60 to 70 feet from lining. However, when ground is bad this is impractical and a safety ring is immediately poured near the shaft bottom or 20 to 30 feet above it. This ring is two feet greater in diameter than the normal shaft so that permanent concreting can be placed with no problems. It is normal practice to install such a safety ring above the brow and below the bottom of each station before it is cut, thus making the wall of the shaft safe when the station is cut.

All concrete is mixed on surface and dropped to shaft bottom through a 6-inch black pipe. It is extremely important to keep this pipe column absolutely vertical and the flanges machined and aligned without any internal irregularity, as pipes have worn through in a matter of hours when a slight deviation from the vertical has occurred, or if the flanges have been slightly out of alignment.

Present practice is to establish permanent buntons, pipe lines, and guides behind sinking so that the completed shaft is finished closely behind sinking. Previously the best equipping time had been six weeks. Permanent sets are now kept about 200 feet behind the bottom with men working on a platform suspended from and 15 feet below the bottom set. Sets with 30 foot guides are installed during the drilling cycle.

In drilling the round the use of hole directors is standard practice and drilling to a definite pattern is strictly followed. The accuracy of drilling a long round in a circular shaft is of utmost importance. Any small bulge in wall can foul the stage of concrete forms and throw the cycle out of sequence.

After the round has been almost mucked out the bottom is cleaned with compressed air. All bootlegs from previous rounds are pumped out and carefully inspected for undetonated powder. They are then plugged with wooden plugs.

Investigations are underway to cut down drilling time and obtain a more uniform round by use of drill jumbos. The design of the mechanical grab is being improved.

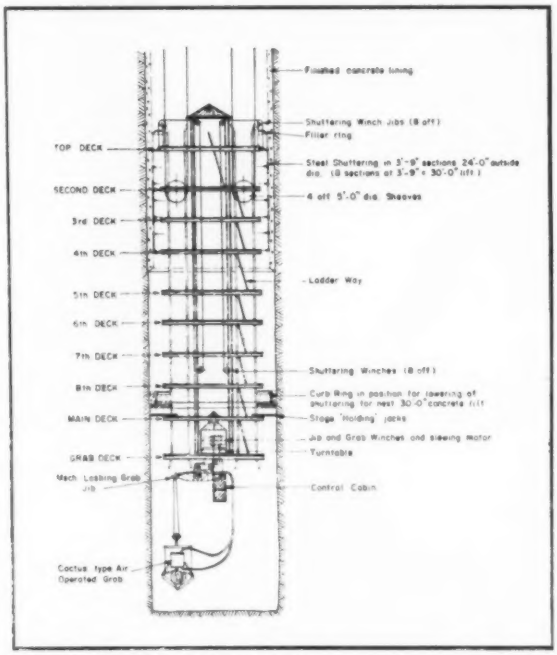
Free exchange of information and close cooperation between the mining companies had added greatly to sinking rates. The importance of such exchange of information in advancing mining techniques in all its branches can not be over-emphasized.

Mr. MacConachie is consulting engineer, Anglo American Corporation of South Africa, Ltd., Johannesburg, Union of South Africa

Average Shift Times For Sinking and Lining Circular Concrete Shafts in South Africa[1]

Sinking	Time In Minutes	Lining[2]	Time In Minutes
Reentry	15		
Lower stage		Lower and prepare	
Examination	210	curb ring	100
Muck round		Pour curb ring	30
Blowing over	60	Place forms	30
Drilling	90	Pour forms	90
Load and blast	75		

1. Total time 7.5 hours. Average advance per round, 8-feet.
2. Complete lining cycle and extend shaft services on other shifts.



SINKING STAGE with 10 decks for simultaneous mucking, stripping 30-feet of forms, and placing 30-feet of forms.

Synthetic Scheelite From Korea

The Korea Tungsten Mining Company, operator of the world's largest scheelite mine, has placed its new $3,000,000 synthetic scheelite refinery in operation. The new plant was designed by Utah Construction and Mining Company's mining and design departments in Palo Alto, California. Utah maintained an advisory staff in Korea to assist the tungsten company in plant construction. Arthur Kendall headed this staff for several years, but is now back in the United States. He was suceeded by Earl O. Torgerson, who is staying in Korea to give technical supervision during initial plant operations. All plant construction and machinery installation was done by Tungsten company employees.

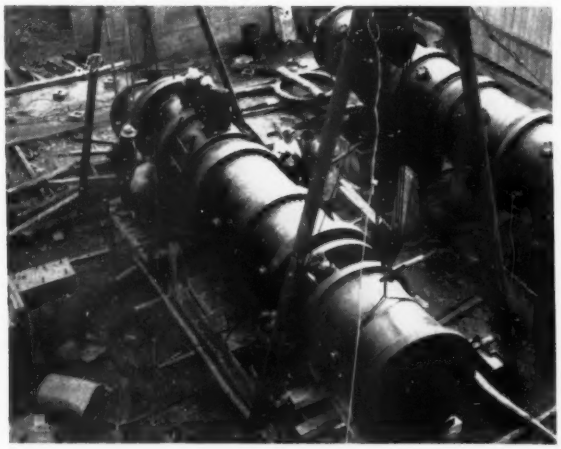
Sang Dong has produced a table and flotation concentrate for a number of years. However, this concentrate, which assayed about 65.0 percent WO_3, 1.24 Mo, 0.56 Bi, 0.03 Cu, 1.33 S, 2.56 Fe, 0.30 P, and 0.02 Sb, always sold at a substantial discount on the world market. The new refinery will produce a virtually pure scheelite with very low impurities which will be as high grade and pure as any concentrate in the world.

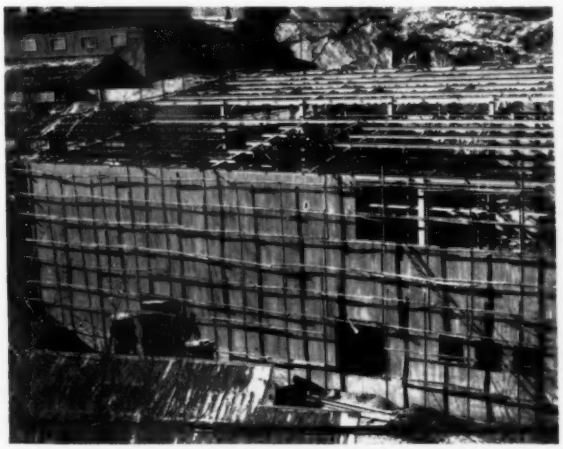
The contract for the new plant was signed by the Tungsten company and Utah in December 1955 and the formal dedication was in May of this year.

The plant uses heat, pressure, and sodium carbonate in a reactor vessel under controlled temperatures and pressures to selectively form soluble tungsten and molybdenum salts. Molybdenum is removed from solution by one of several methods to leave a pure scheelite solution from which the synthetic scheelite is precipitated.

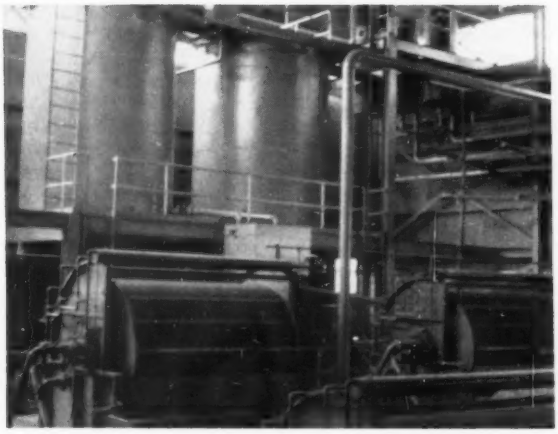
The mine was operated by the Japanese until the end of World War II when the Korean government took possession. In 1952 the International Cooperation Administration awarded Utah a technical contract to improve and mechanize mining operations and install flotation in the mill. In 1953, when these improvements had been made, 7,456 tons of concentrate were produced and sold to the United States government. Recent annual production in an era of world over-supply has been about 3,700 tons. In 1958 it was 3,012. END

Installing Digestors and Erecting Steel Buildings





Inside and Outside, Most Modern Synthetic Scheelite Plant



RECEPTION LINE at opening cocktail party held in Brown Palace hotel marked the official start of the 1959 convention. Raymond Salvati, president of the AMC is shown at right shaking hands with lady.

CAMERA CATCHES A. O. Lundquist, Union Carbide Nuclear (left) and Frank Coolbaugh, American Metal Climax, Inc.

Technical Developments Top Program

Mining engineers, metallurgists, and geologists highlighted the program of the American Mining Congress which held its western meeting in Denver, Colorado, from September 14 through 16. Senators, governors, and many other governmental spokesmen also appeared, but it was the engineers that drew the delegates to hear their informative papers, to view the many carefully prepared drawings projected by slides, and see the excellent photographs used to illustrate the reports.

State of the Industry

Iron ore imports in the year 1965 will more than double the 1958 import level, according to R. W. Whitney, vice president, Hanna Mining Company. World iron ore supplies are more than ample for the immediate future, but over the long term, new sources of major magnitude will have to be developed, continued Mr. Whitney. He foresees iron ore imports of 60,000,000 tons by 1965. The 1958 figure—28,000,000 tons.

Most of this increased import tonnage will come from sources now being operated or under active development. For example, Canada can now export 17,000,000 to 20,000,000 tons of ore annually to the U. S. and Europe. Mr. Whitney said that by 1965 Canada would be capable of exporting 34,000,000 tons per year. Similar potentialities exist for South America, where all known major deposits are being carefully studied.

Diversification is the answer to most of the problems confronting the mining and minerals industry today, said David C. Minton, Jr., vice president of Battelle Memorial Institute. To find the diversification opportunities, technical, economic and market research are needed. Mr. Minton stated that no producer of basic raw material has much chance for profitable operations from the selling of his primary metal alone these days. Research may not be the whole answer for the mining and minerals industry, he concluded, but it should be a big help.

Delay in formulation of a national long-range minerals program has resulted not from lack of Administration support, but because there is no Congressional directive, Senator Gordon Alcott of Colorado stated. He noted that Congress, during the past two years, had rejected two Administration proposals for the relief of depressed segments of the industry. He labeled this a demonstration that Congress has not yet decided that the objectives the Administration sought to achieve in those plans are in the national interest.

Metallurgical Synopsis

Operating experience has demonstrated that the leach-precipitation-flotation process is a workable and an effective method for improving recovery of copper from semi-oxidized ores, declared Arthur W. Last, chief of the ore dressing section, Kennecott Research Center, Kennecott Copper Corporation. The Ray Mines Division's L-P-F facilities have yielded metallurgical results equal to and possibly superior to, the laboratory and pilot plant test results. Mr. Last reported that indicated average copper recovery at Ray Mines is about 10 percent higher than could have been achieved with conventional sulphide flotation which the L-P-F method replaced. The new facilities at Ray Mines Division, including L-P-F processing, the sponge iron plant and the new smelter, were described in June 1959 MINING WORLD.

Mr. Last pointed out that the successful application of L-P-F processing at Ray Mines indicates the possibility of further utilization of the process for semi-oxidized ores—particularly those containing readily soluble copper silicates and carbonates.

Francis L. Hoderreed discussed X-ray analytical methods used in process control at The Anaconda Company's copper concentrator at Anaconda, Montana. Co-author of the paper was William Lucy. They stated that the X-ray technique was successfully applied to the continuous monitoring of all typical mill pulps containing a copper content ranging from the levels of final concentrates at 22 to 32 percent, to bulk tailings at 0.10 to 0.25 percent. The quality of the X-ray assays of copper content approximated those of conventional wet methods. In addition, the assays were available continuously, or instantaneously at discontinuous intervals, upon choice.

Pilot plant tests on the amine process for the flotation of oxidized zinc ores were reviewed by William C. Aitkenhead, Director of the Mining Experiment Station, Washington State University. Bench scale tests on oxi-

BUNKER HILL COMPANY was well represented by John D. Bradley president (left) and Wallace Woolf, vice president from the company operations at Kellogg, Idaho.

THREE INDUSTRY OBSERVERS were John D. Sullivan, Battelle Memorial Institute (left), Robert Palmer, secretary, Colorado Mining Association (center) and Colo. state senator Cheever.

at Mining Congress Session in Denver

dized zinc ores from Washington and pilot plant tests have been carried out. Results indicate that ore from surface workings of Pend Oreille Mines & Metals Company is amenable to the process. Mr. Aitkenhead also reported on the use of an emulsion of stearic acid, kerosene, and soap as a collector for autunite, uraninite, uranophane, and monazite. He also described a method for flotation of chrysocolla using sulphuric acid, sodium sulphide, Aerofloat 31, Reagent 404, and pine oil. The Washington State University method for floating chrysocolla was described in July 1959 MINING WORLD.

The problem of transporting 1,800 tons per day of copper-nickel sulphide concentrates through 7½ miles of 8-inch wood stave pipeline was described by D. A. Fraser, assistant mill superintendent, International Nickel Company. Feasibility studies of pumping bulk concentrate were started following a decision to build a new concentrator for the Sudbury, Ontario facilities. Extensive testing revealed that the concentrate could be relayed by means of five pumping stations.

Mining Report

A pleat folded belt conveyor which can convey up a 40° slope and make several turns in a horizontal plane was described by R. B. Jordan, chief engineer, Universal Atlas Cement Division, U. S. Steel Corporation. This new equipment is in operation at the company's gypsum mine in the state of New York.

The belt is of molded rubber sections shaped like pans on a pan conveyor. Beneath the rubber belt are steel trough-shaped stiffeners which attach to a centrally located chain. Support and guidance of the belt is provided by roller carriages located on about three-foot centers which ride in U-shaped rail guides on either side of the conveyor. The equipment is manufactured in West Germany.

Robert E. Kendall of U. S. Borax & Chemical Corporation said "you have to throw away the book" when it comes to conveyor practice used by the Germans. He stated in a report on wheel excavators and belt conveyors in open-pit lignite mines, that the Germans are running miles of belts at from eight to 1,200 feet per minute. He also declared that the Germans gave up the 20° troughing idler years ago in favor of the 30° idler.

It cost $550 per foot to sink the first 300 feet of a new, concrete-lined, circular, underground shaft at the molybdenum mine of American Metal Climax, Inc., stated William F. Distler. The cost includes excavation, concrete lining, manway and service facilities. The shaft is being sunk to open new levels at 300-foot intervals below the Storke level which is expected to approach depletion by 1970.

Yieldable steel ring sets were successfully used and conventional rigid steel sets failed because they could not successfully withstand tremendous forces at Hecla Mining Company's Silver Mountain project in Idaho. Wallace E. Crandall, Hecla's chief engineer, said that the yieldable ring sets were 8 feet in diameter, weighed 15 pounds per foot, and were spaced 4½ feet apart. They were lagged tightly with 4 by 10-inch lap-jointed fir lagging all the way around. See April 1959 MINING WORLD for Mr. Crandall's report.

Idarado Mining Company held the line on costs by cutting back nonproductive labor, introducing faster drilling carbide bits, and using lower grade explosives, explained general superintendent A. C. Hilander. See September 1959 MINING WORLD for a comprehensive report on Idarado's methods.

The most significant developments in the ammonium nitrate, fuel oil (AN-PO) system were listed by professor Melvin A. Cook of the University of Utah as: (1) clarification of the influence of the surface-active, long chain hydrocarbon coatings as compared with the kieselguhr coating for prilled AN; (2) improved methods for increasing density, velocity, and borehole pressure in the AN-FO system; (3) development of new, higher density AN types for use with fuel oil; and (4) the development of new improved boosters for this and other relatively intensive AN explosives.

A 64-ton semi-trailer end-dump truck is doing an excellent job at Kaiser Steel Corporation's iron mine, stated Martin Hughes, but it is not the ultimate answer to truck haulage. Three types of trucks are used at Eagle Mountain—22-ton end dump, 36-ton end dump, and the 64-ton unit. The 64-ton unit hauls for about 68.8 percent of the cost of hauling with the 22-ton truck.

This is the most economical

Haulage cost, including maintenance on these S-D Automatic Bottom Dumping Cars, the locomotive plus labor for haulage, is less than 5¢ a ton!

1. There haven't been any door damages to these cars . . . nor any derailments due to door mechanism failure. We design to take the service. We know of many derailments of other type cars due to high center of gravity, dumping members sticking out on the side of cars, etc. We invite you to ask those who have experienced the dependability and economy of our S-D Automatic Bottom Dumping Cars.

BUT, you might ask, *how it is possible for bottom dumping mine cars to take such punishment?*

Can the hinge and latch mechanisms take the impact of shock loading?

It doesn't appear bottom dumping cars could have continuity through the center. Then, isn't the drawbar and buffing of the loads taken from the coupler out to the sides, through the sides and around them?

Do the latch mechanisms and hinges, no doubt foolproof in coal or potash service, become hopelessly clogged when running through wet muck which contains clay, leached ore, etc.?

The answer to all these questions is that S-D Automatic Bottom Dumping Mine Cars can be designed to meet any, all and every requirement.

Let's take those pictured on this page in operation in a hard rock mine, and give you the specific reasons in answer to your well put questions. Then mention the general advantages of bottom dumping cars, such as automatic dumping without labor, which provide the most economical way to haul rock and ore.

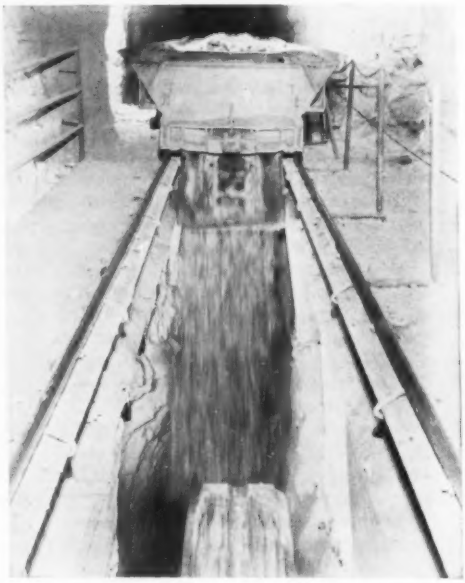
This car was designed more along the lines of coal cars. No special consideration was given for severe loading conditions. The mine that purchased them had previously experienced 15 years of hard rock service with similar S-D Automatics, also designed for coal service.

After five years service, they are averaging 8¼ tons of hard rock and making more than 12 turnovers per shift. One man, his locomotive and 10-cars-only in a trip frequently load from three different chutes and dump 125 cars in a shift.

As we have reported, their haulage cost, including maintenance on both cars and locomotive plus labor for haulage, is less than 5¢ a ton.

2. Note the Twin Unlocking Devices prior to being raised remotely by operator from his locomotive.

3. The Twin Safety Latches on S-D Automatics must be operated independently but simultaneously to open doors. Only mechanism that can achieve this is the Twin Unlocking Devices mounted between rails at the dump.



4. Here is an action picture, showing first car in trip of 10-cars dumping on-the-move. Part of the Automatic Door Re-Locking Mechanism may be seen in lower part of picture.

5. This is a difficult picture to obtain, but you may see image of door during the Automatic Re-Locking action as trip continues its non-stop dumping and return for re-loading.

way to haul hard rock and ore

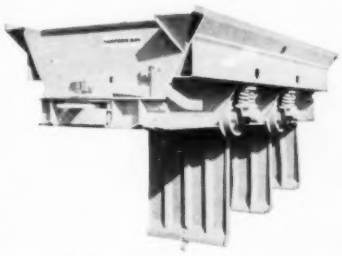
A few of the latches have been broken and a few of the trunnions have been bent during those five years. On repeat orders for cars to operate under similar service conditions, we are using T-1 Steel in the trunnions as well as a fabricated steel latch, which eliminate these minor, in-frequent repairs.

Note that the car is otherwise designed for shock loading, having spring mountings. We have also furnished rubber mountings.

The S-D Automatic's Twin Jerk-Out mechanism is located well above the rail. As far as wetness of muck, the service has been severe, but no difficulty has been experienced.

You may see in inset picture at right this S-D Automatic prior to shipment. You have here a photographic comparison of the car prior to installation, then after five years service.

We can prove by mathematics, and can back mathematics with more than 40 years experience in building bottom dumping mine cars, that our car structure, as far as side sills, bumper construction, etc., is designed to take drawbar pull and buff of heavy trains. In fact, this construction is many times stronger than such items as tail bolt or standard link or pin.



You will be interested in the S-D Automatic pictured below. Here is one of our designs for extremely heavy duty. Further it was developed to solve particular handling problems.

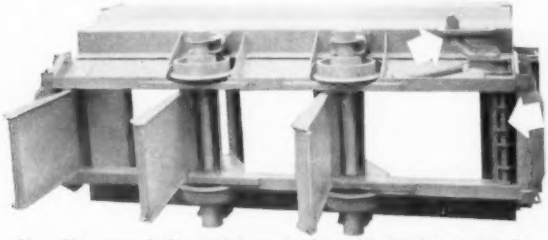
The material this customer handles is very sticky and will not shed well. They had tried all types of cars, including side dump, rocker, gable, etc. They felt they had a better chance of getting the muck out of our S-D Automatic Bottom Dumping Car. Their judgment has proved correct.

These S-D Automatics were designed with all flares on 60 degrees. Too, false bottom doors were furnished to also aid in clean shedding.

They also wanted the largest possible car in drift driving. This would cut down on car change. The S-D Automatic enabled them to obtain the greatest capacity for overall dimensions that could be let down the shaft without dismantling.

Automatic couplers were shipped separately for mounting underground.

The cars were equipped with 18″ wheels with spring mounted trucks.



Note (by arrows) the special cam latch on this S-D Bottom Dumping Car and full width door support. This car was designed specifically for handling iron ore, plus it enabled the customer to obtain more capacity within their dimension limitations than any other type car they could buy!

Note special cam latch at rear end for full width door support.

What we are discussing here is an S-D Automatic specifically designed for hauling iron ore and tailor-made to a customer's requirements. Some of the major specs on the car you may like to know are: 36″ Track Gauge . . . 46″ Wheel Base . . . 15′ 6″ long . . . Shipping Weight 9,440 lb.

Only bottom dumping mine cars effectively provide automatic, no labor, dumping. Only bottom dumping mine cars provide for such simple, low cost dumping facility. Too, S-D Automatics enable you to use large ore pass as surge bin to keep continuous supply of material for uninterrupted operation of mill . . . keeps mill and mining operations separate for efficient operation of each.

We believe the two requirements to obtain the most economical haulage system are (1) Minimum capital investment in haulage system, and (2) Minimum direct operating costs.

The reasons why S-D Automatics best meet these two requirements are:

MINIMUM CAPITAL INVESTMENT—

a. More tons per car per shift hauled (fastest car turnover) which means LESS CARS needed!

b. Maximum loading speeds (see inset picture at right showing how cars pictured on page at left are loaded by locomotive operator himself. Note the remote controls. They can operate locomotive remotely, or S-D Hydraulic Car Spotter or S-D "Brownie" Hoist, and open and close the chute).

c. Maximum dumping speed (automatic non-stop without labor)

d. Maximum surge bin capacity (no loaded cars waiting at dump)

MINIMUM DIRECT OPERATING COST—

a. Automatic controlled loading

b. Fewer cars and fewer locomotives

c. Automatic Dumping (no men required)

We hope we have pointed out here by actual case experiences answers to questions you have had . . . that you are satisfied immediate consideration should be given to these S-D Automatics . . . that you want to get in touch with us to discuss the matter in detail. Every haulage situation is an individual problem, and it is your situation we both are interested in at this moment. May we hear from you? *Sanford-Day Iron Works, Inc., P.O. Box 1511... Telephone 3-4191, Knoxville, Tennessee*

SANFORD-DAY

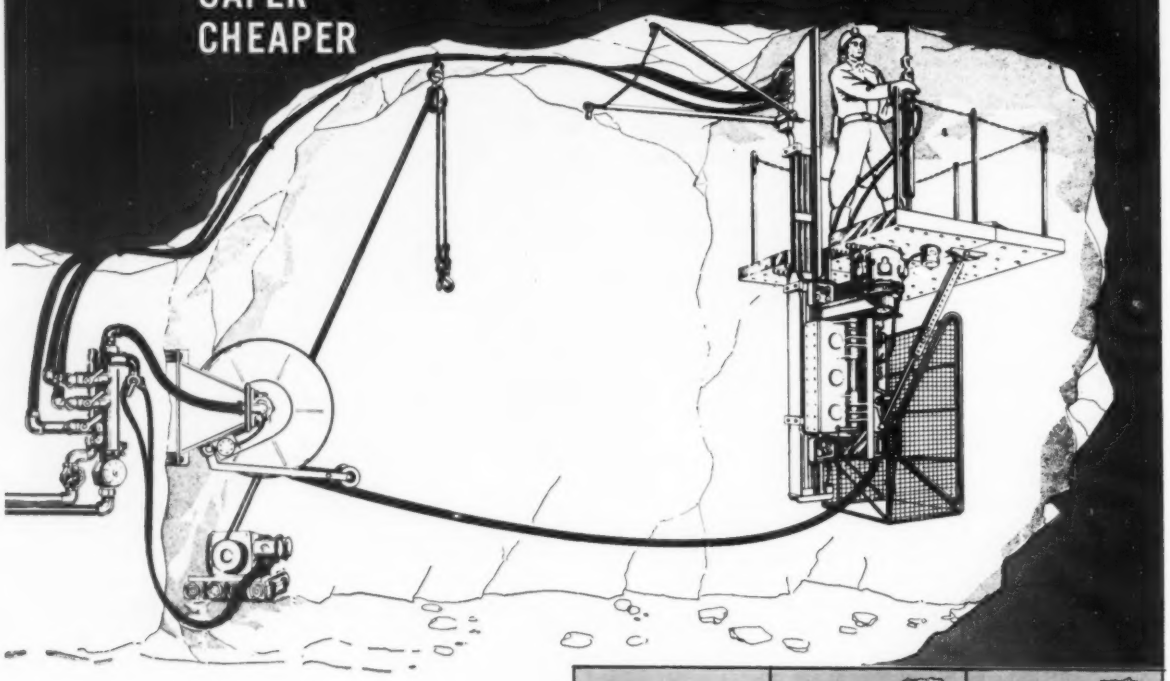
KNOXVILLE, TENNESSEE

MINE CARS—all types . . . S-D Brakeman Cars . . . S-D Man Cars . . . S-D Hydraulic Car Spotters and S-D "Brownie" Hoists . . . S-D Automatic Loading Stations for mine and railroad cars . . . S-D "Floater" Wheels . . . S-D Mine Sheaves and Rollers . . . S-D exclusive Hard-Facing Process that puts old wheels back in operation for years of additional service.

NEW ALIMAK Raise-Climber*

Provides fully self-contained elevating system for driving raises from 40 ft. up to 1200 ft. or more

FASTER
SAFER
CHEAPER



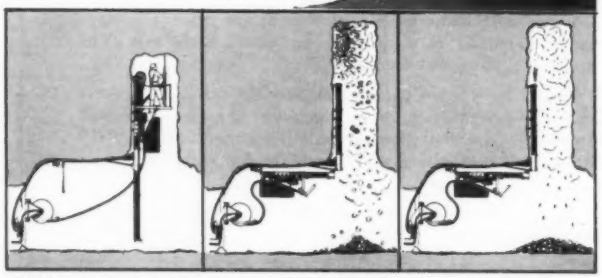
This major advance in driving raises is not only faster in all types of rock, but eliminates much of the heaviest and most dangerous work associated with existing methods. The *Alimak Raise Climber* consists of an easily portable all steel elevator which quickly climbs a rack equipped guide rail. The operator is raised to the working face where he drills for charges. After descending, the platform is folded back for blasting, cleaning out and ventilating. Operator then ascends and fits another 3 ft. or 6 ft. rail section for the next drill-blast cycle.

One man can carry out all operations with fingertip control of four services housed in rail section — air, water, electricity and telephone.

Thoroughly tested and proved in over 60 worldwide mining operations, the *Alimak Raise Climber* holds the *Mining World/World Mining Magazine* 1959 *Blue Ribbon Mining Award.*

Complete sales and service representation available throughout the United States. Write for full details, today.

*Patent Pending



Climber moves up guide rail, fastened to rock by expansion bolts. Permits full range of operations at face of raise.

Bottom guide rails and *Climber* swing back under cover of the roof for blasting. *Raise-Climber* method eliminates staging and restaging.

High-pressure water and air provide quick cleanout of gases and dust; assures faster drill-blast cycle in verticle or diagonal raises.

A Product of Swedish Engineering

ALIMAK

RAISE-CLIMBER ELEVATING SYSTEM

Alimak Corporation

306 Avila St., San Francisco 23, California
A Subsidiary of Alimak-Verken AB
Skelleftea, Sweden

PRODUCTION EQUIPMENT PREVIEW

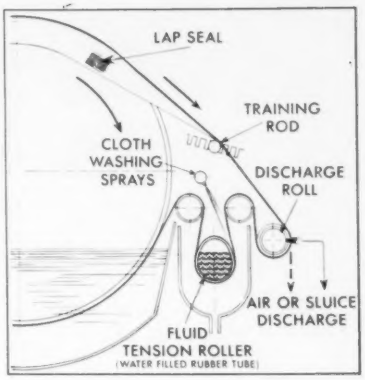
For data on any item on next three pages use the inquiry card opposite page 50

Filter Cloth Discharger Solves Cloth Tracking Problems

Filter medium can be continuously removed from a drum filter, washed thoroughly, and then automatically replaced on the drum by a new patented device licensed by Peterson Filters and Engineering Company. Internal cloth blinding is said to be prevented and cakes too thin for other filters can be completely discharged without blow back.

Big advantage claimed for the unit is a water filled loop that provides fluid tension for cloth. It is reported to be sensitive enough to compensate for the variable stretch in a filter cloth. Peterson spokesmen say that fixed diameter tension rolls tried in past were unsuccessful because they were too insensitive and cloth climbed to high side.

The cloth discharger has been in operation for over two years at U. S. Potash Company for recovering potash brine from mud tailing. The unit is designed for wide commercial application and provides not only the sluice discharge, but a dry discharge. It also eliminates the excess overflow water from the tension loop. The cloth is joined by a zipper for quick replacement when desired. Any suitable cloth can be used, with or without seams. The Peterson cloth discharger can be designed to fit most types and sizes of drum filters. Circle No. 31.



New Powder is Available for Controlled Blasting

A new explosive said to combine the low initial cost features of processed ammonium nitrates with the handling ease and controlled shooting of regular explosives has been announced by Austin Powder Company. The new powder is known as Apcomite and is claimed to produce greater explosive power per foot of loaded blast hole. As a further advantage, it eliminates most shipping, storage, mixing and materials handling problems.

Apcomite incorporates specially processed ammonium nitrate with a primer so that the need for extra priming is nonexistent. Makers says that it is always made under the same uniform conditions, so Apcomite has the added advantage of being adaptable to controlled shooting. The new powder is available in two types that are ready to load and ready to shoot. Apcomite 17 is for all normal usage; No. 20A with greater density is for wet holes. Both are furnished in 23G tubes. Circle No. 34.

Steel Reinforced Tire Tread For Off-Highways Trucks

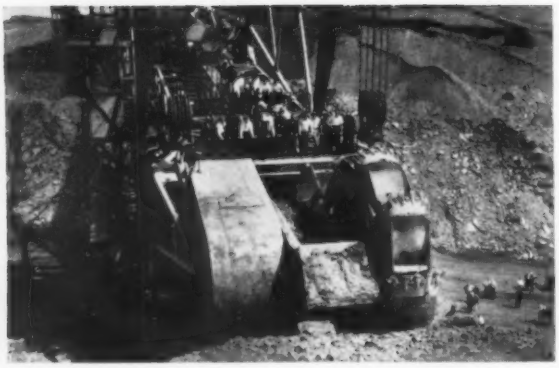
New tires made by U. S. Rubber Company consist of several thick layers of tread rubber containing hundreds of thousands of short lengths of brass-coated hardened steel filaments. The manufacturer reports outstanding results from the new tires in field tests. For example in an Arizona mining area, U. S. Rubber says the S.R.T. (Steel reinforced tread) outlasted all competitive brand tires by an average of 95 percent; a superiority of 69 percent was noted at another Arizona operation of the same company. On the Mesabi Iron range, 93 percent of the tires tested were retreadable in a tough operation characterized by steep grades, tight turns and extremely rocky terrain.

The hardened steel filaments in the new tires are closely interlaced, yet individually rubber insulated. They are said to form a practically impenetrable mat between the tread and the nylon cord body. The manufacturer says that the virtual wall of tool-hard steel in the tire provides added resistance to penetration and cut growth.

The S.R.T. tires were the product of seven years of research, development and field testing. The new super tread is 50 percent deeper and is said to offer 25 percent more gripping area plus 51 percent more rubber to protect shoulders. Circle No. 32.

Heavy Duty Feeder

New heavy duty feeder with a capacity up to 1,000 tons per hour has been added to the line made by Jeffrey Manufacturing Co. It is said to be ideal for controlled feeding from bins, hoppers to belt, crushers, etc. The 6-D (pictured) is equipped with a 60 by 90-inch open pan deck and renewable liner. It can be furnished with various deck styles. Circle No. 28.



Wheel Excavator Rights Are Purchased by Bucyrus Erie

Plans and patents of the Kolbe wheel excavator, the largest earth moving machine ever built in America, were acquired by Bucyrus Erie Company. This machine which has been used in strip coal mines, may be used in large scale stripping of uranium and other big earth moving jobs.

The machine shown in the pictures is 46 feet wide, 150 feet high and weighs 2,100 tons. It is equipped with a 27-foot diameter wheel with ten 2.5 cubic yard buckets. A chain mat forms the back of each bucket to provide continuous self cleaning action. The excavated material is discharged from the wheel to the belt over a roll feeder consisting of four steel rollers which rotate at speeds increasing from wheel to belt. From the ladder belt, the material drops onto a stacker belt. Circle No. 33.

Portable Compressor

A gasoline powered single stage compressor is now in production by LeRoi Division, Westinghouse Air Brake Company. The new unit is portable, has a 125 cubic-foot-per-minute capacity. It provides enough air to power two heavy or three medium breakers, one medium or two light sinkers or one light wagon drill. Circle No. 13.

Electric Wheel Haulers

Two electric wheel machines are hauling 50 tons each at an expressway project in Dallas. Every wheel has individual electric motor geared directly to its rim (note oversize hub which conceals motor driveshaft and gearing inside each wheel). Manufacturer is R. G. LeTourneau, Inc. of Longview, Texas. Machines have no clutches, transmissions or other mechanical-drive components. Circle No. 19.

New Unit Seals Bags

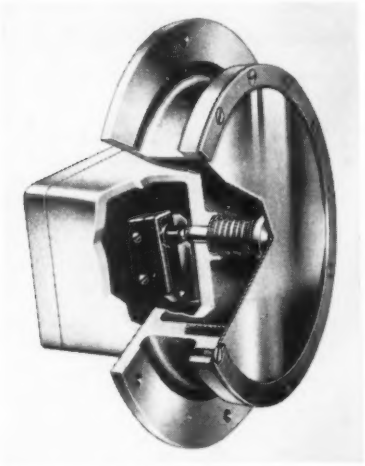
An electric heat-sealing unit designed to close a poly-lined (multi-creped) kraft bag used to package ammonium nitrate-fuel oil mixtures has been developed by Bemis Bro. Bag Company. It was developed to seal the new waterproof explosives bags. The sealing unit weighs 25 pounds, operates on a 110-volt electrical system. The bag is locked between jaws for sealing. The unit forms a ¾-inch seal through the Flexiply sheets in five seconds. Circle No. 4.

Automatic Density Control

Denver Dowsett density control valve is utilized as an automatic sand bleed valve on all machinery where dense pulp must be discharged continuously or automatically. It consists of a housing and a diaphragm operated valve. The diaphragm keeps the valve closed due to water pressure. When enough solids accumulate to overcome the differential in pressure, the valve opens and discharges at 70 to 80 percent solids. Following the discharge of solids water pressure on the diaphragm automatically closes the valve. No power or manual control requirements are necessary. It can be used to discharge hutch products from Mineral or Plunger jigs, thickeners, settling cones and hydroclassifiers. Manufacturer is Denver Equipment Company. Circle No. 2.

Automatic Features on Block

Automatic alignment of latch pin hole with holes in the side frame is one of several new features claimed for the new "E" series sheave blocks made by Alloy Steel and Metals Co. Automatic centering eliminates any hole hunting with latch pin. The "E" series block is available in eight and 12-inch sizes. Circle No. 35.

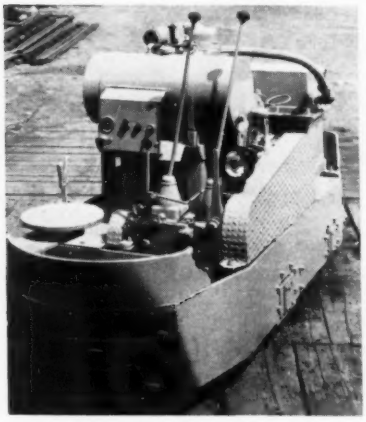


Bin Level Indicator

A new, automatic bin level indicator is especially suited for applications where corrosion and chemical action may be factors. It was introduced by The Bin-Dicator Company. The unit is said to offer super-sensitive response for control of levels of light, low density materials or heavy, dense, coarse or abrasive material. Circle No. 77.

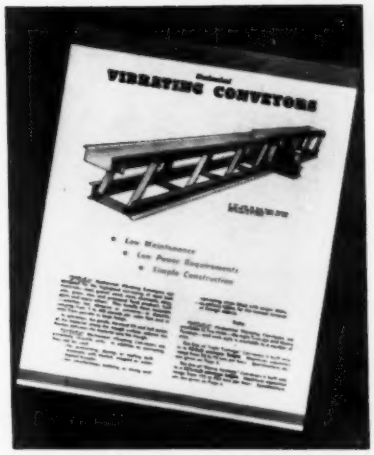
New Off-Highway Truck Has Low Center of Gravity

A new off-highway, end-dump truck features a new air-hydraulic suspension system that is said to completely eliminate maintenance and repair of springs. Made by LeTourneau-Westinghouse, the Haul-pak trucks come in three size models—32-ton, 27-ton and 22-ton. The dump body is V-shaped, a feature which increases carrying capacity within a short wheel base. The new trucks are said to be capable of turning in less space than the average pick-up. With a 130-inch wheelbase, the trucks can turn in an area only 44½ feet wide. Circle No. 75.



Underground Trammer

Junction Bit & Tool Company has developed a small Diesel locomotive which is finding increased uses in many small mines. It has a standard gear shift enabling multiple speed operation, and travels at about seven miles per hour in high gear. One of these trammers at the Beaver Mesa uranium mines of Climax Uranium Company pulls seven 1-ton cars on a 0.5 percent grade without trouble. The machine sells for about $3,300. PEP No. 98.

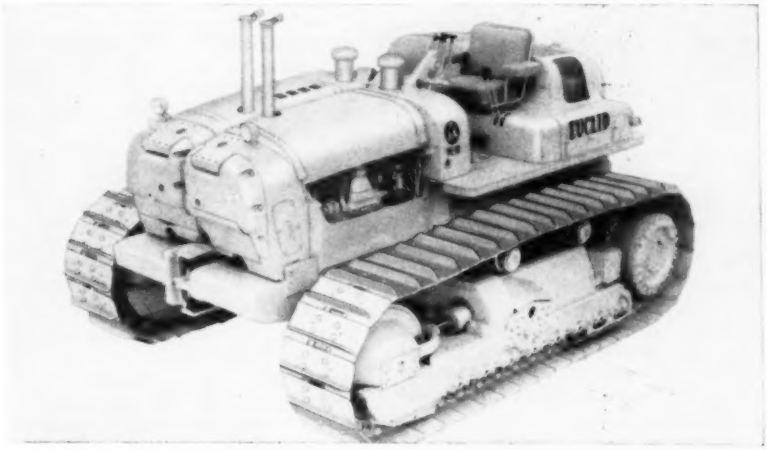


Vibrating Conveyors

Mechanical vibrating conveyors for highspeed transport of bulk materials are described in a comprehensive four-page catalog by Syntron Company. Biggest advantage of the Syntron vibrating conveyors is that they can carry out several functions in addition to simple conveying of material in bulk.

Typical applications include preheating, drying, or cooling of the conveyed load by use of heated, stepped or water-cooled troughs. They can be used for simultaneous scalping or sizing of the load when they are fitted with screen decks. They can also be used as picking tables for hand-sorting operations.

The catalog gives complete descriptions, sizes and specifications for seven standard vibrating conveyors (four light tonnage models and three heavy tonnage models). Copies are available from Syntron Company, 166 Lexington Ave., Homer City, Pennsylvania. Circle No. 76.



Twin Crawler Available Throughout World

A new series Euclid TC-12 crawler tractor is available for sale by Euclid dealers throughout the world. The tractor is powered by two GM-671 Diesel engines delivering a total of 425 net hp. The unique design feature of the TC-12 is the use of two independent main frames to provide free oscillation of each half of the tractor. These are joined and kept in correct alignment by a 6⅝-inch diameter pivot shaft extending the full width of the tractor. The tractor has a separate power train for independent drive of each track. Circle No. 27.

Lima Type 2400 dragline speeds iron ore stripping operations.

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Lima shovel team speeds Mesabi Range ore loading—Type 604, left, 1½ cu. yd., and Type 1201, 3 cu. yd.

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CENTRIFUGAL PUMPS in new "AW" series made by Nagle Pumps, Inc., are self priming and feature a trap with readily removable strainer. Pump capacities range up to 100 gpm with heads to 125 feet. New line is available with choice of three bearing stands. Circle No. 36.

MOTIVE POWER BATTERIES, are described in new 48-page service manual which details the operation, maintenance, charging, trouble shooting, and repair of C & D Slyver-Clad series. Fundamentals of battery theory are included. Circle No. 37.

NEW CAP LAMP provides 15 percent more illumination and a reduction in overall weight reports Mine Safety Appliances Company. The new line is designated the Model S. Circle No. 38.

DRAGSCRAPER method lengthens range of draglines according to a field report by Sauerman Bros., Inc. Line drawings and photos show how to extend dragline range and handle difficult jobs. Circle No. 39.

NEW TRANSIT features automatic collimation. It is made by Will Heerbrugg Instruments, and has a rapid reading microscope mounted next to the telescope. It also has an internal optical micrometer which allows both circles to be read directly within 20 seconds with interpolation to 5 or 10 seconds. Circle No. 40.

BATTERY CHARGERS: A short course on operation and maintenance of a new line of motor-generator chargers is offered in a bulletin published by Exide Industrial Division. The Electric Storage Battery Company. Circle No. 41.

MOISTURE PROOFING of electrical equipment can be carried out with a new liquid which is said to preserve insulation and end corrosion. The chemical, called CRC, has a low surface tension rendering it capable of penetrating every crack. It comes in drums, quart cans or spray cans. Manufacturer is Corrosion Reaction Consultants. Circle No. 42.

NICKEL CASTING ALLOYS: A quick guide to nicket-containing casting alloys has been published by International Nickel Company. The booklet presents in condensed form, informative data on the range of properties offered, industries served and general applications for each of the alloys included. Circle No. 21.

STEEL REINFORCED TIRES developed by United States Rubber Company outlasted all competitive-brand tires by an average of 95 percent in an Arizona copper mining area according to company spokesmen. Tire was developed after seven years of research and it consists of several layers of tread rubber containing hundreds of thousands of short lengths of brass coated, hardened steel filaments. Circle No. 22.

FLOTATION CHART published by Armour Industriail Chemical Company lists Armour reagents and minerals to which each is applicable. Also included is similar data for flocculents and conditioners. Circle No. 23.

SPEED REDUCERS are outlined in two new booklets containing engineering data on shaft-mounted in-time helical and right-angle helical speed reducers. Both are available from Hewitt Robins, Inc. Circle No. 24.

NEW RUBBER SHEETING is said to be abrasion resistant and made for do-it-yourself covering of chutes, bins and launders. Developed by B. F. Goodrich Industrial Products Company, the material is also suitable for patching conveyors. Circle No. 25.

JOY SLUSHERS of medium capacity (15 to 40 horsepower) are the subject of a new bulletin which includes data on two and three drum units for continuous heavy duty application. Circle No. 26.

AMERICAN FILTER is described in a new bulletin which outlines the design, and principle operating features of this disc-type unit. Dorr Oliver states that the American filter is designed to provide maximum filtration area per square foot of floor space. Circle No. 20.

SHEAVE BLOCKS: New series "E" quick opening, wide-throat sheave blocks with automatic centering of latch pin in side frames are described in Bulletin 292 published by Alloy Steel & Metals Co. Circle No. 9.

HYDROMETALLURGICAL products for process operations involving ion exchange, chemical feeding, leaching, oxidation, carbonation, purification and clarification are described in 8-page Bulletin 90 by Infilco, Inc. This bulletin should become part of the reference library of most metallurgists. Circle No. 10.

COMPRESSED AIR: Fundamentals are covered in an informative new booklet published by Ingersoll Rand Company. It contains data on cfm of air required for a variety of pneumatic equipment and is designed to help anyone select a compressor. Circle No. 11.

FOR GAS MASKS, hose masks, air line respirators, and demand breathing apparatus, Mine Safety Appliances has designed a completely new facepiece featuring a large, replaceable lens. Circle No. 12.

PIPE REPAIR CLAMP that has been newly developed by Marman Division, Aeroquip Corporation, is said to conform to the contour of the pipe under high torque without biting into pipe. Unit is made for pipe in sizes ¾-inch through 8 inches in diameter for quickly and easily repairing pipe leaks. For details circle No. 14.

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NEW V-BELT has been introduced by United States Rubber Co. It is said to offer a 40 percent horsepower rating increase. New process is said to impregnate cords with latex in every fiber. Circle No. 57.

VARIABLE DRIVE: Sterling Motors, Inc. has issued a completely new bulletin No. 195 on variable speed drives. Circle No. 17.

V-BELTS: An improved version of Goodyear Tire & Rubber Company's E. C. Cord Green Seal V-belt with a 40 percent increase in horsepower ratings has been placed on the market. Circle No. 18.

BIN VIBRATOR which is more powerful has been added to the HI-VI line made by Eriez Manufacturing Company. Two models are available: one provides impact of steel on steel, and the second provides a cushioned impact. Circle No. 60.

SEMI-AUTOMATIC WELDER for build-up and hardfacing is described in a new 4-page folder published by American Manganese Steel Division. Circle No. 62.

LUBRICANTS for heavy industry are outlined in an illustrated folder by D-A Universal Lubricant Company. Circle No. 66.

NEW SLURRY PUMP for heavy duty service in handling abrasive pulps has been announced by Morris Machine Works. Type RX pump features low pressure stuffing box and access to wearing parts without disturbing piping. Sizes range from 2 to 6 inches. Circle No. 67.

DUST COLLECTOR: New bulletin by American Air Filter Company describes AMERclone, a dry centrifugal designed to handle large exhaust volumes of granular dust. Circle No. 69.

PREPACKAGED MEALS for nearly every conceivable type of field conditions are available in a variety of individual packs from Boston Farm Packing Company. Exploration groups and mining companies will be interested in catalog describing the service. Circle No. 52.

CONVERSION FACTORS most commonly used by engineers are listed on a new wall chart available from Precision Equipment Company. Circle No. 53.

TWO WAY RADIO: A four page folder titled "Two-Way VHF-FM Mobile Radio System" describes features of the new Aerotron model 6N15 made by Aeronautical Electronics, Inc. The new model is said to be extremely compact and has a 6, 12 and 115 volt power supply. Circle No. 15.

CONSTRUCTION PROBLEMS involving earthmoving, dredging, sand filling, and stripping are detailed in a 32-page bulletin by Construction Agregates Corp. Called Men, Methods & Machinery, it contains information on a number of engineering aspects of unusual projects. Circle No. 16.

ARC WELDING cable connections and accessories are described in a catalog just published by Tweco Products, Inc. Circle No. 17.

NEW MACHINE is said to screen, scrub, and classify feed material and discharge five washed and accurately classified products. Gyra-San Company, Inc., makers of the unit, reports that it has been used for processing manganese, gold, silver, and lead ores. It is designed to disintegrate clays or sticky and loosely cemented materials. Circle No. 56.

FEEDER - WEIGHER - CONVEYOR made by Schaffer Poidometer Company is described in bulletin released by the manufacturer. Unit is said to be extremely accurate for feeding dry, crushed materials. It is self-contained and mounted on a heavy steel channel frame. Circle No. 7.

BASIC REFACTORIES: New brochure gives a brief description of the entire range of H. K. Porter Company's refactory products in quick reference form. Circle No. 8.

HOTPLATE-SHAKER has been developed by Eberback Corp. It is a rotating, tilting unit for application in lab and assay office. Circle No. 44.

SELECTIVE DRIVE HUBS for the new Ford spicer axle 4-wheel drive are now available from Warn Mfg. Co. Locking hubs for conversion front drive units made by Napco and Marmon-Harrington are also marketed by Warn. Circle No. 45.

MINE HOIST ROPE with internal electrical conductors has been developed by Wickwire Spencer Steel Division, The Colorado Fuel & Iron Corp. Telephone communications or actuation of relay signals are natural applications. Circle No. 46.

CAR WHEEL ASSEMBLIES for replacement of existing units on heavy duty material handlings cars with 3 to 25 tons capacity are now being mass produced by Irwin Sensenich Corp. Circle No. 47.

ROPE THREAD DRILL TOOLS for blasthole work are described in a flyer from Brunner & Lay, Inc. The new line includes, rope thread rock bits, rope thread extension steel, couplings and striking bars. Circle No. 49.

STORAGE BATTERIES: Care and maintenance of those units intended for motive power installation is the subject of a 20-page bulletin by Exide Industrial Division, The Electric Storage Battery Co. Circle No. 50.

PORTABLE AIR HOISTS that conserve time and remove work load from busy shop cranes have been developed by Ingersoll Rand Company. They offer 1,000 pound capacity. Circle No. 51.

NEW TIMBER CAGE introduced by Machinery Center, Inc. is designed for shaft timbering operations. It transports a full set of timbers down the shaft, contains provisions for converting the timber skip into a staging when in position. Circle No. 1.

INDIRECT DRYER carries very fine material on a solid plate conveying surface which is heated from below by low pressure steam or heated air. It was recently developed by Jeffrey Manufacturing Co. Circle No. 3.

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William T. Pettijohn, who has been assistant to the vice president in charge of mining and exploration, has been appointed as manager of mines for the New Jersey Zinc Company, with headquarters in New York City. Mr. Pettijohn started with the company in 1948 at the Austinville, Virginia mine. Since 1957, he has been assistant to the vice president in charge of mining and exploration.

Phillip T. Maddex, formerly manager of the Henderson, Nevada plant of Titanium Metals Corporation, has been named chief engineer of United States Borax & Chemical Corporation, and will direct corporate engineering activities from headquarters in Los Angeles, California. A graduate of Ohio State University with a degree in chemical engineering, Mr. Maddex has served in various engineering capacities with General Electric Company, Battelle Memorial Institute, and the National Lead Company.

Donald W. Lindgren, formerly chief mining geologist of the Northern Pacific Railway, and **Ernest K. Lehmann,** consulting geologist, have announced the formation of the firm of Lindgren & Lehmann, consulting mining geologists, with offices at 1355 North St. Albans, St. Paul, and 14504 Waymouth Road, Minneapolis, Minnesota. Prior to his association with Northern Pacific, Mr. Lindgren was general manager of Minera Dominica C. por A., Dominican Republic, general manager of West Indies Mining Corporation in Puerto Rico, and geologist for Oliver Iron Mining Division. Mr. Lehmann has been assistant to the Central District geologist with Bear Creek Mining Company.

Richard C. Cole, vice president of Vitro Uranium Corporation at Salt Lake City, was recently advanced to the presidency of the firm—a division of the Vitro Corporation of America. He succeeds **William B. Hall,** who was recently named vice president of the Vitro Corporation of America, New York City.

Fred M. Zeder, II, has been elected president and chief executive officer of Hydrometals, Inc.—formerly Illinois Zinc Company. **William H. Hayden,** president of Hayden Metals, a wholly-owned subsidiary of Hydrometals, was named chairman of the board. Mr. Zeder and Mr. Hayden succeed **Morris Blumberg,** who resigned both offices.

Johnson Crawford and **A. A. Hayes** have been named assistant managers of the New Jersey Zinc Company, with headquarters at Jefferson City, Tennessee and Grand Junction, Colorado, respectively. Since starting with the company in 1945 as a geologist, Mr. Crawford has been assistant to the superintendent at Austinville, Virginia, head of exploration in Tennessee, and general superintendent of Tennessee operations. In his new position he will direct all company activities in the Tennessee area. Mr. Hayes was first employed as an engineer at New Jersey Zinc's Gilman, Colorado mine, over 30 years ago. He will have charge of the company's Western mining operations and serve as technical consultant for milling methods and procedures at all the company's milling operations.

Leland W. Milligan, Jr. has been appointed as research engineer to the chemical engineering research department of United States Borax & Chemical Corporation's subsidiary, U. S. Borax Research Corporation at Boron, California. Mr. Milligan is a graduate of the University of Iowa with a master's degree in chemical engineering.

Charles E. Haberman, formerly with Homestake-Sapin Partners at Grants, New Mexico, is now chief chemist with Union Carbide Nuclear Company at Rifle, Colorado.

Richard V. Wyman has resigned as vice president of Western Gold and Uranium, Inc. in order to assume the duties of president of Intermountain Exploration Company of St. George, Utah. This new company has been formed for the purpose of exploration in the western areas of the United States.

J. W. Burgess, who has been manager of construction of the Uranium Reduction Company, Moab, Utah, will be promoted to the position of chief engineer for the American Zinc, Lead and Smelting Company and all subsidies at the Fairmont City, Illinois division office. Mr. Burgess joined the American Zinc organization at Dumas, Texas in 1948, as plant engineer.

L. R. Leville, director of quality and production control at Kennecott Copper Corporation's Nevada Mines Division mill at McGill, Nevada has been promoted to mill superintendent. He will succeed **W. J. Akert,** retired for reasons of health; **R. L. Perry,** presently quality test engineer will succeed Leville.

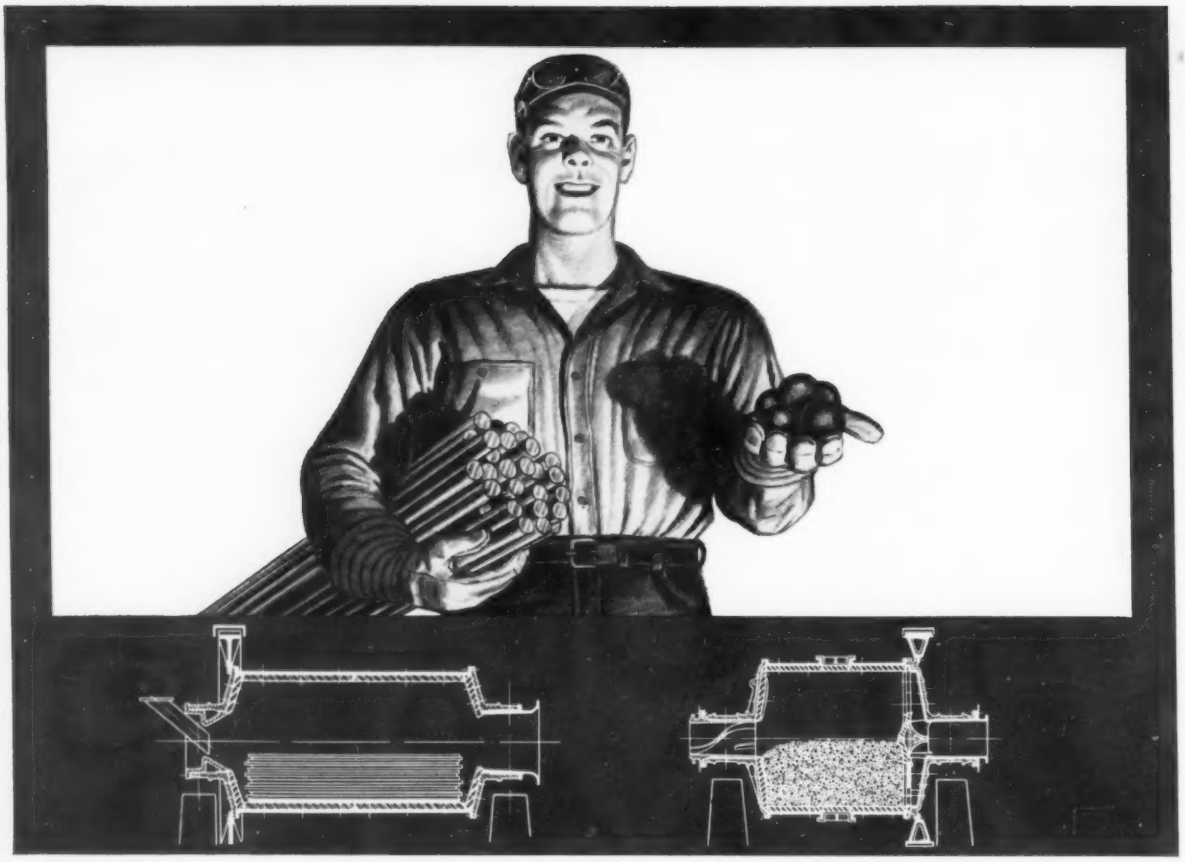
Fred A. Brinker has been appointed as general manager, Western Division, Vanadium Corporation of America, to succeed **D. W. Viles,** who is retiring. Formerly chief metallurgist, western division, Mr. Brinker has been associated with the corporation in an engineering capacity since August, 1951. He is a graduate of the Colorado School of Mines.

Dr. Charles A. Anderson has been appointed to succeed **Dr. Wilmot H. Bradley** as chief geologist of the United States Geological Survey. Dr. Anderson received his Ph.D. from University of California and taught there for several years prior to serving as assistant chief and later as chief of the Mineral Deposits Branch of the USGS. As a research scientist, his work on the volcanics of northern California, studies of the geology and copper mineralization in the Bagdad district, Arizona, and investigations of Arizona pre-Cambrian formations, have contributed greatly to the mining industry.

Reserve Mining Company, Silver Bay, Minnesota, recently announced three advancements. **Wayne E. Apuli,** was advanced to supervisor, Development and Control; **Carl W. Virant** to chief process engineer; and **H. A. Engman** to chief chemist.

Henry "Pete" Nichols has been named industrial relations administrator by the Bunker Hill Company, Kellogg, Idaho. Mr. Nichols, a graduate of Cornell University, was formerly employed at Pocatello, Idaho by the Westvaco Mineral Products Division of Food Machinery and Chemical Corporation.

At a recent meeting of the Wyoming Mining Association **Myron L. Sisson,** superintendent of the Colorado Fuel and Iron Company mine near Sunrise, was elected president. He succeeds **Glenn E. Sorensen,** president of Kemmerer Coal Company at Frontier, Wyoming. **Robert E. Love** of Green River was named secretary-treasurer. At the meeting, **Governor J. J. Hickey** of Wyoming presented the "Bronco Buster" certificate to **Niel McNiece,** the Riverton prospector whose discoveries led to the development of the big Gas Hills uranium district. This certificate is awarded annually to the Wyoming citizen making an important contribution to the development of the state.



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NEWSMAKERS IN WORLD MINING

EDMUND C. BITZER, metallurgical consultant of Golden, Colorado is now in Yugoslavia as ore dressing consultant to the Yugoslav government. His mailing address is c/o Elektrobiro, P. F. 942, Belgrade. One of his first jobs will be to supervise operation of a new gold cyanide mill. Mr. Bitzer has managed gold mills in the Philippine Islands and Malaya; was metallurgical consultant to the United States Atomic Energy Commission's Raw Materials Division in the Union of South Africa and the United States; and until recently was metallurgical consultant to Western Nuclear Corporation's uranium mill at Jefferson City, Wyoming.

Gordon M. Godfrey, formerly mine manager for Northspan Uranium Mines Ltd. at its Spanish American property in Canada, has been transferred within the Rio Tinto management group to manager for the Algom Quirke mine. He succeeds **G. L. Hatherly,** who has transferred to the managership of Northspan's Lacnor mine.

Director **Ehrhardt Andreas** of Hazemag GmbH, West Germany, has been honored by the Technische Universitat Berlin with the degree of Doctor-Engineer honoris cause, based on the excellent achievements of Mr. Andreas and his company with regard to selective impact crushing.

The Steel Company of Canada, Limited has announced several management changes. **George B. Elwin,** vice president and treasurer of Stelco has retired following 22 years of service to the company. He is succeeded by **Robert B. Taylor.** Replacing Mr. Taylor as secretary and assistant treasurer is **W. C. Chick. Norman J. Brown,** comptroller, has been promoted to vice president and comptroller.

MERRILL A. MOSHER, left, manager of Chile's newest mine, Andes Copper Mining Company's El Salvador, located near Potrerillos, Chile; ALFONSO GREZ, (center) Consul General of the Republic of Chile; and RODOLFO MICHELS, right, vice president of the Andes Copper Mining Company at Santiago, Chile, are shown above welcoming the arrival of the first shipment of copper from the El Salvador mine at Raritan Copper Works' Perth Amboy, New Jersey plant. This is the first blister copper to be produced by the Anaconda subsidiary at its new mine.

F. G. Sharp, superintendent of Kolar Gold Mining Company's Mysore mine in India, is proceeding on leave to the United Kingdom. His address will be 26 Clinton Road, Redruth, Cornwall, England.

Dr. J. P. Kearney, superintendent at the Nkana concentrator of Rhokana Corporation Ltd., has been transferred to Rhodesian Anglo American offices at Salisbury, Southern Rhodesia, and has been succeeded by **Dr. M. G. Atmore,** previously cobalt refinery superintendent.

J. M. Herndon, assistant general manager of Quebec Iron and Titanium Corporation, has been appointed to general manager. Mr. Herndon, a graduate of the University of Kentucky, was formerly general superintendent of Cramet, Inc. at Chattanooga, Tennessee, and previously employed by Union Carbide Corporation at Oak Ridge, Tennessee.

CHANG KUN CHUNG, formerly chief mining engineer and now controller for Korea Tungsten Mining Company's Sang Dong mine, has recently been observing mining practices at Bunker Hill Company, and Sidney Mining Company, Kellogg, Idaho, Cordero Mining Company in McDermitt, Nevada, and Trout Mining Company at Phillipsburg, Montana. Mr. Chung's tour was sponsored by the International Cooperation Administration.

E. R. Tickton, manager director of Wright, Anderson (S.A.) Ltd., Boksburg, North, South Africa, recently visited Iron Mountain, Michigan, U.S.A. and toured nearby mines and plants. His company is part of Anglo-Transvaal Industries, Ltd., South Africa.

V. J. Wells has been appointed director of Inyoni Mining and Exploration Company Ltd., South Africa. He succeeds **A. Ferrier** who has resigned.

Ivor Herbert, formerly uranium plant superintendent, Rhokana Corporation Ltd., Northern Rhodesia, has resigned to take up an appointment with Rio Tinto Company Ltd. of London in the United Kingdom.

W. L. Dotson is presently a flotation mill shift boss with Southern Peru Copper Company at Toquepala. His mailing address will be Casilla 303, Tacna, Peru.

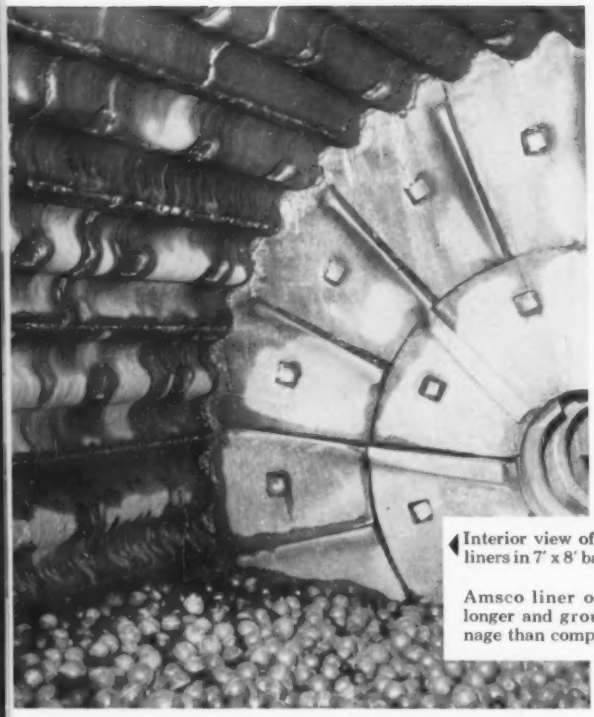
Dr. W. J. Busschau, joint general manager for New Consolidated Gold Fields, Ltd. in the Union of South Africa and former director of Luipaards Vlei Estate and Gold Mining Co., Ltd., has been elected president of the Transvaal and Orange Free State Chamber of Mines for 1959-1960. **P. H. Anderson** and **C. B. Anderson** of the Central Mining Corporation's Rand Mines group and the Union Corporation group, respectively, have been elected vice presidents for the same period.

Some of the largest mines and plants in Canada were visited in September by the following geologists and mining engineers on a two-month study tour under United Nations auspices: **Henry C. Kirk,** geologist, geological survey, British Borneo; **Charles H. L. Sirimanne,** deputy government mineralogist, Ceylon; **Chingchang Biq,** director of the geological survey of Taiwan, Republic of China; professor **Sydney G. Davis,** advisor to Hong Kong government on minerals; **Pataki K. Chatterjee,** superintending geologist, Geological Survey of India; **Mr. Johannas,** geologist of the Geological Survey of Indonesia; **Abolghassem Mir-Afzali,** director of engineering department, Plan Organization, Teheran, Iran; **Dr. Katsu Kaneko,** director of Geological Survey of Japan and **Goro Mori,** director, mining division, Sendai Regional Bureau of International Trade, Japan; **San Ku Lee,** chairman and director for Han Kook Geological Industry Co., Seoul, Korea; **Keong Sooi Chung,** geologist and Ahmad Azizuddin, inspector of mines, Federation of Malaya; **Romeo R. Villaraza,** mineral development planner, Phillipines; **Jumchet C. Javanaphet,** senior geologist, and **Prachuap Kaaosai,** inspector of mines, Thailand. The study tour, jointly sponsored by the UN Bureau of Technical Assistance Operations and the UN Economic Commission for Asia and the Far East, has been arranged to help the group advance their knowledge of modern geological and mining techniques and equipment used in the development of mineral resources. After the two-week tour, the group will return to UN headquarters in New York to prepare their reports, and will leave for their respective countries about October 10.

Engineer **D. Antonio De Branco,** formerly Director of Geological Services at Cascais, Portugal, is now with the Geological Services of Portugal at Rida Academia das Ciencias, M° 19-2°, Lisbon.

H. JOAQUIN FELSCH, manager of Western Machinery Company's International Department, uses a model to demonstrate the WEMCO Sand-Sort system to ARSEN PENSA, director of Radusa Chrome Mines, Macedonia, Yugoslavia. Mr. Pensa visited this metallurgical firm's San Francisco, California, offices during his tour of United States mining and metallurgical operations. His trip is part of the program currently being conducted by the International Cooperation Administration

How AMSCO helps you HANDLE



Interior view of Amsco double wave liners in 7' x 8' ball mill, using 2" balls.

Amsco liner on left lasted 123% longer and ground 134% more tonnage than competitive liner on right.

Bucyrus 88 D four-yard bucket, equipped with Amsco Simplex 2-part Teeth, removing rock for power station. All of Tuscarora Constructors' shovels used for rock excavation are equipped with Amsco Simplex Teeth.

MORE TONS PER DOLLAR

Read how AMSCO Mill Liners and Dipper Teeth are outlasting competitive parts in severe service

THEY'VE DOUBLED SERVICE LIFE WITH AMSCO CHROME-MOLY BALL MILL LINERS

Amsco double wave chrome-moly liners are used on an Allis-Chalmers 7′ x 8′ ball mill at this large northern New York zinc mine. The mill is operating *24 hours a day, six days a week* . . . grinding rod mill discharge consisting of sphalerite, pyrite and the balance silicate and limestone gangue.

These Amsco liners ground 670,000 tons during their 29-month life . . . as against an average of 286,000 tons and 13-month life for the type of liners previously used. That adds up to over *100% increase in service life.* In addition to their longer life, another fact that impresses the operators about Amsco liners is that there's no circumferential grooving until the very end of their service life.

AMSCO 2-PART DIPPER TEETH ARE "BEST-WEARING TEETH WE'VE EVER USED"

At the Niagara Power Project, Tuscarora Constructors are building the power station and pumping station. They're digging almost entirely in rock, working their dippers 24 hours a day, six days a week.

Dell Lundmark, Equipment Superintendent for Tuscarora, was responsible for selecting Amsco 2-part reversible teeth for his dippers. He'd heard of their fine performance elsewhere, and now describes them as the "best wearing teeth we've ever used". He says the design of the teeth is very good for rock, and adds, "We're getting *15% to 20% longer wear* than from competitive 2-part teeth".

Approximately 10,000 tons of rock are handled before the teeth are turned over . . . and tips are easy to replace when completely worn.

This combination of a new alloy steel, plus the design features engineered into the Amsco Simplex Teeth, are causing equipment superintendents everywhere to change to Amsco for better, lower cost digging.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

Other Plants in: Denver • Los Angeles • New Castle, Dela. • Oakland, California • St. Louis

In Canada: Joliette Steel and Manitoba Steel Foundry Divisions

EUCLIDS RUSH

"Life-Line"

TO ORE MINE

Because of its location in a very remote and practically inaccessible area of northern Quebec, a big iron ore mining development awaits completion of a new 200 mile railroad. When operations are in full swing, iron ore from Quebec Cartier's new mine will be transported by rail to Port Cartier, east of Shelter Bay on the St. Lawrence River. From there it will go by ship to steel mills in the United States, Canada and Europe.

Construction of this railroad through rugged country is a big tough job—one that requires dependable, large capacity equipment to keep the rush project on schedule. Pitts-Foley Co., contractors, are using 25 Euclid Rear-Dumps of 22-ton capacity. Powered by diesel engines of 300 h.p., these "Eucs" haul heavy rock excavation from cuts to fill areas. In spite of steep grades, rough roads and an operating schedule of 20 hours 6 days a week, these heavy duty haulers are maintaining an availability record of 90% or better.

With over 25 years of experience in building specialized earthmoving equipment, Euclid and its world wide dealer service organization offers you bonus benefits that bring a greater return on investment. See your Euclid dealer for technical assistance with any off-highway hauling problem.

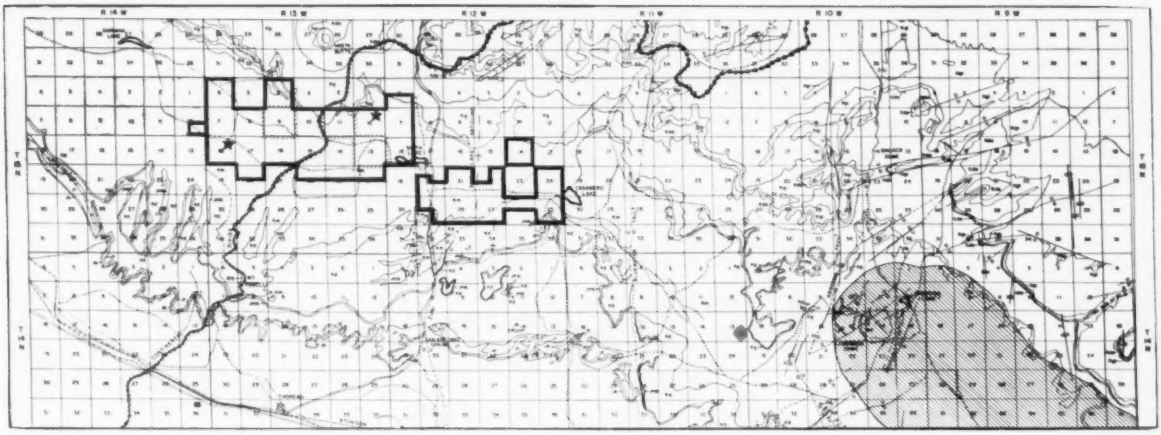
EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

WHAT'S GOING ON IN MINING



New Uranium Mines Extend Ambrosia Trend to West

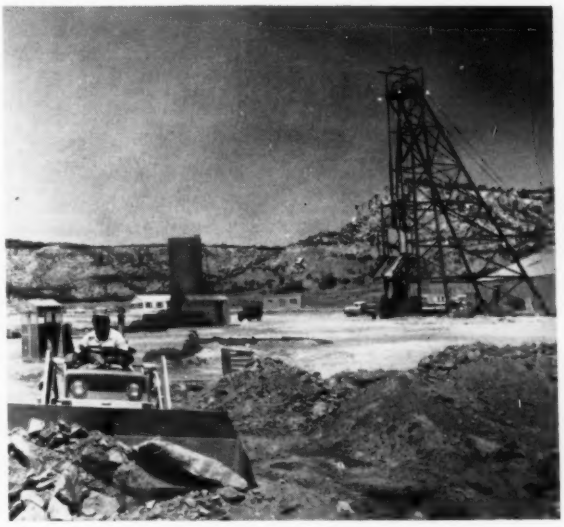
Homestake Mining Company has purchased a 25 percent interest in two sections of New Mexico uranium property held by Lance Corporation, wholly owned subsidiary of Sabre-Pinon Corporation. The transaction involves $1,350,000 and covers 1,280 acres in Sections 11 and 12, T15N, R21W, McKinley County. An additional 16,000 acres in the area are controlled by Lance.

This new area is outlined on the map above. Stars indicate Sec. 12 mine, in which Homestake has the interest, and Sec. 18 mine which Lance is also developing. All of the property had been held by Black Jack Corporation, before it was acquired by Sabre-Pinon and transferred to Lance. Lance will continue as sole operator of both mines, now named Black Jack I and II.

The Black Jack I (Sec. 12) is estimated to contain 600,000 tons of 0.30% U_3O_8. Its headframe can be seen in photo at right. Ore depth is at about 750 feet. Now in production, the mine is designed to produce 600 tons per day.

The Black Jack II contains about 80,000 tons of 0.40% U_3O_8, and is designed to produce 300 tons per day. Its shaft bottom is anticipated at about 350 feet, and should be ready to go into production shortly. Exploration has also located a third ore body and possible existence of other deposits.

The shaded area in lower right portion of map is the main mineralized area of Ambrosia Lake where Homestake-Sapin Partners have developed three mines. Note that the Ambrosia ore trend is now being extended to the west.



Bagdad Hopes To Cut Water Use with Ion Exchange

Re-opening of the Bagdad Copper Corporation's electrolytic pilot plant at its mine at Bagdad, Arizona, is scheduled shortly, according to George Colville, general manager. The $250,000 plant, built in 1956 as an experimental and research center for production of finished copper sheets from copper concentrate and low grade leached copper deposits, was operated on a full production basis until July 1957, with satisfactory results. At that time, production was discontinued in order that the plant's facilities could be utilized for further research.

At the time production was discontinued, the company was using the standard industry method of precipitating the copper from leach solutions by passing it thru a stockpile of de-tinned cans, the contact resulting in metallic copper being formed. This method, which is still widely used in other copper mines, proved successful. However, there were drawbacks, principally the high cost of the cans, which could be used only once, and the high water loss, an important factor in a location where water was scarce and expensive. Hence, it was decided to search for an improved method.

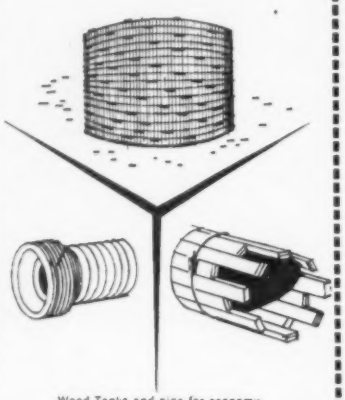
After two years of intensive research by a team of Bagdad Copper Corporation chemists and metallurgists, comprised of R. C. Bogart, assistant general manager; E. S. Howell, chief metallurgist, and F. H. Wheadon, chemist, a potential process was devised through the adaptation of an ion exchange unit coupled with a resinous flow. In effect, the copper-bearing solution from the leached ore is piped through a circuit where it contacts the resin, which replaces the de-tinned cans formerly used. During the contact, a chemical reaction causes the copper particles to attach to the resin particles in a highly concentrated mass form.

In the former process, 30 gallons of water were required to salvage 114 grams copper. In the new process, the same amount of copper can be claimed in one gallon water. Thru an additional process, the water and resin can be reclaimed and used repeatedly.

According to Mr. Colville, it is planned to operate the pilot plant on a round-the-clock basis for several months to further test the process.

Asarco's Mission Copper Project Gets Go-Ahead

American Smelting and Refining Company has launched its $43,500,000 Mission copper project, located about 15 miles



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southwest of Tucson, Arizona. The Board of Directors has authorized this amount to prepare and equip for production an open-pit copper mine and mill in Pima County. Operation is predicated on a yearly tonnage of 5,400,000 . . . exactly double the output of Asarco's Silver Bell property which is 40 miles northwest of Tucson.

Ascarco has been exploring the area for several years by surface drill holes and a shallow shaft from which drifts and crosscuts were driven for bulk sampling and to secure metallurgical test samples. These samples proved that the ore is "simple to treat"; however, it varies greatly from very soft to very hard, depending on location in the deposit. Grade will also vary widely as the pit develops, so it will be a mining problem to maintain both tonnage and grade.

As the ore body does not crop out, it will be necessary to strip about 200 feet of unconsolidated alluvium and caliche overlying the deposit. Various methods of stripping have been considered, including bucket-wheel excavators, dragline, and shovel stripping with conveyor belts. Final decision is to use 8-yard electric shovels and 30-cubic-yard Diesel trucks.

For additional information on this project, see MINING WORLD, July and September 1957, and September 1959.

ARIZONA

Bear Creek Mining Company, Kennecott Copper Corporation's exploration subsidiary, has filed 204 claims covering 4,080 acres of state land in Cochise County, Arizona. The firm reports it intends to explore for copper, and has filed the claims as a matter of routine in order to conduct more testing. Additional work will be necessary to determine whether this Bowie area has any commercial potentail.

An intensive airborne and ground search for mineral wealth will start shortly on the 1,600,000-acre San Carlos Apache Indian Reservation in Arizona. Located in Gila and Graham Countries, the reservation starts near Globe and extends east almost to Clifton and Morenci. Holder of an exclusive prospecting permit is **Hunting Geophysical Service Inc.** of New York City. The permit is good for 14 months and provides for prospecting in three stages: 1. First two months to examine all of the existing geological and geophysical data available, with minimum expenditure of $5,000. (Low-grade mangaese and asbestos are known resources.) 2. For next six months, to spend a minimum of $50,000 to make an airborne geophysical survey of the entire reservation. 3. Ground follow-up of promising airborne findings. Expenditure at the rate of $100 per section ground tested is required. If any valuable deposits are found, Hunting Geophyscial will have an exclusive option to obtain as many leases as it wants, each covering a maximum of 2,560 acres. The leases, however, will not apply to oil and gas. They carry a minimum of royalty of $1 per acre and minimum rent of $1 per acre. The contract also provides that, wherever possible, Apaches will be used in production. Some 4,700 Indians live on the reservation.

CALIFORNIA

Under a recently completed agreement, **American Potash & Chemical Corporation** of Los Angeles, California will exclusively develop the use of and distribute **Molybdenum Corporation of America's** rare earths in the glass industry. Moly Corp. owns and operates the world's largest rare earth deposit at Mt. Pass, California. It will continue to mine and sell rare earths in the steel, metallurgical, and other fields.

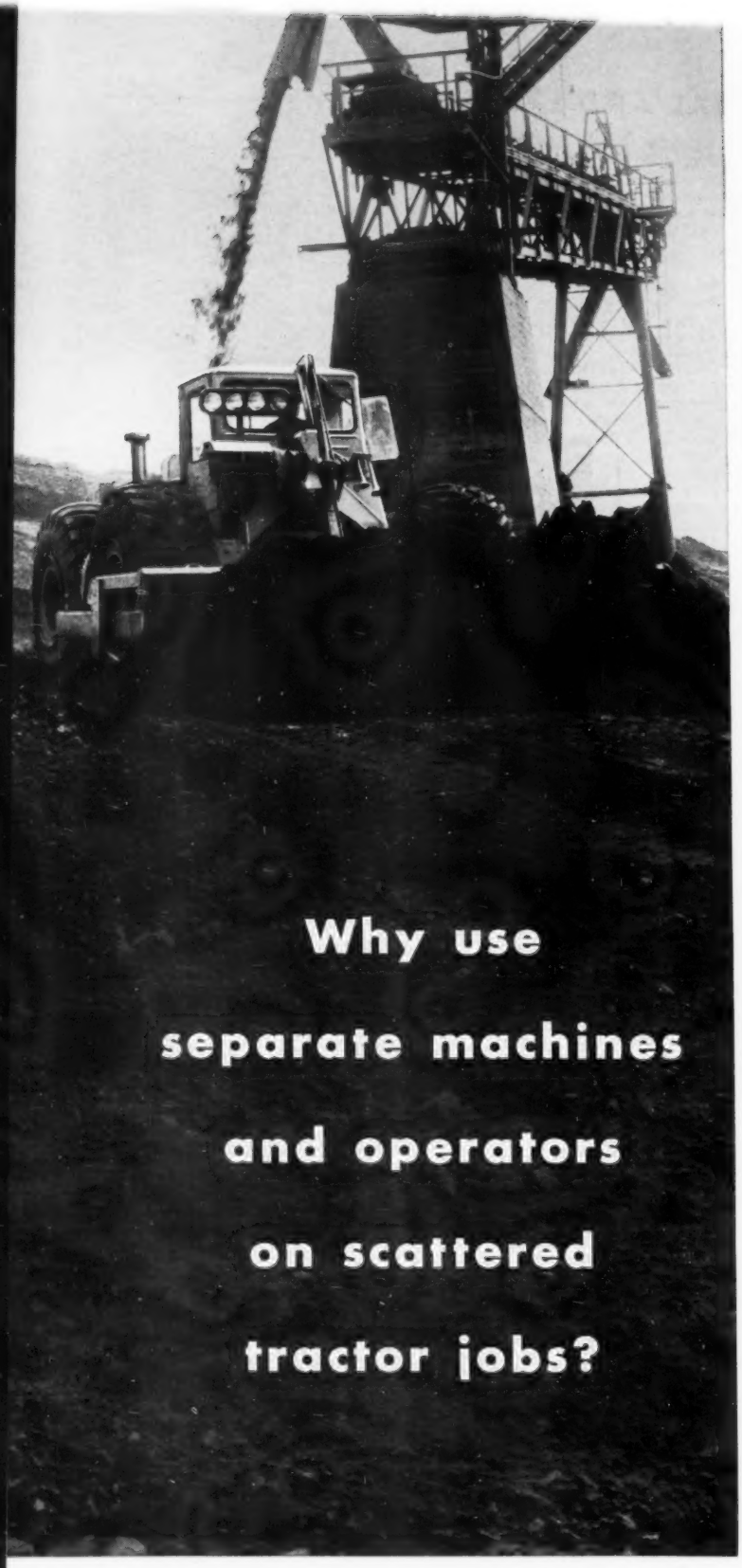
NEW MEXICO

During its three-week vacation shutdown, **U.S. Potash Company,** division of **U.S. Borax & Chemical Corporation,** at Carlsbad, New Mexico made several major repairs. Included was replacement of the 21-foot hoist shaft which had been installed in 1933; replacement of the conveyor case and feed chutes of the Redler conveyor systems in the granular plant; complete disassembly and overhaul of the hoist motor at No. 1 shaft; removal and overhaul of the "insides" of the gyratory crusher. Also completed during the shutdown was installation of equipment for experimental modification of one of the regular Swenson crystallizer bodies. If successful, the experiment will improve the quality of the company's white muriate product and will also increase production capacity of the product which is presently produced exclusively by seven Struthers-Wells crystallizer units.

The **American Gypsum Company** of Albuquerque, New Mexico plans to build a $3,000,000 gypsum plant for manufacture of building products. Gypsum will come from the **White Mesa** deposit near San Ysidro, about 30 miles northwest of Albuquerque. Reserves are reported at more than 98,000,000 tons. Construction is scheduled to start in September, and to be completed late in 1960.

Mechanics of the **U.S. Potash Company,** division of **U.S. Borax & Chemical Corporation,** have converted a CD-42 jumbo drill from a dual operation to a one-man operation. All of these drills will now be changed over. They have also revamped the jumbo's hydraulic system to save on the number and length of hoses needed. The new hydraulic system will increase efficiency by decreasing temperature of the hydraulic fluid and elimination of friction areas where the hoses have been rubbing together.

International Mining Days and the **Annual Meeting of the New Mexico Mining Association** will be held in El Paso, Texas on October 28, 29, 30, and 31. Contact the El Paso Chamber of Commerce for further information.



Why use separate machines and operators on scattered tractor jobs?

Handle your widely-scattered pit maintenance and clean-up jobs swiftly and economically with one man and a LeTourneau-Westinghouse Tournatractor. This rubber-tired tractor speeds to the job under its own power . . . over paved roads, cross country or over railroad tracks. There are no delays while tractor crawls to new locations.

LW tractors give you better speed at the work area, too. Acceleration is fast, with 218-hp operating through sealed anti-friction drive. Maneuverability is quick and easy. Also, there's no loss of momentum to shift gears, because this tractor's gears are constantly in mesh. Even reverse action is *instant*.

Handles wide variety of jobs

You can use just one Tournatractor to clean-up around 2 or more shovels . . . and at the same time to maintain stockpiles, level waste dumps, clean debris off RR tracks, clean benches, handle shallow stripping, tow air-compressors, or pull supply and service wagons. You can even use this speedy, mobile tractor for maintenance and clean-up in one or more adjoining pits.

Biggest tractor value today!

In addition to giving you these plus operating advantages, LeTourneau-Westinghouse Tournatractor *costs less* to own, and *much less* to maintain than a track-type tractor of comparable horsepower. Write for complete details. Our world-wide Distributor organization assures you of prompt and efficient parts and repair service.

◀ Powerful LW Tournatractor spreads and compacts conveyor-dumped mineral-bearing soil. At the plant mobile rubber-tired tractor also pulls rail cars, handles dump maintenance, and operates a towed scraper.
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Drilling Symposium Set At Pennsylvania State

The ninth annual Drilling Symposium will be held from October 8 to 10 on the Pennsylvania State University campus at University Park, Pennsylvania. All mining engineers and geologists are invited to attend.

This symposium is under joint sponsorship of the Colorado School of Mines, University of Minnesota, and Pennsylvania State with meetings alternating among the respective campuses.

Highlight of the symposium will be a series of papers on "Improving Core Recovery." Annan Cook, development geologist for Kennecott Copper Corporation at Safford, Arizona, will present a paper on Core Recovery in Diamond Drilling of Western Coppers; Ian Reid, Oliver Iron Mining Division, Thomas E. Stephenson, Jones & Laughlin Steel Corporation, and Richard Randolph, Cleveland-Cliffs Iron Company, will detail Recent Experimental Rotary Core Drilling on the Mesabi Range. Other papers on Canadian iron drilling and Rhodesian copper drilling are scheduled.

Separate series of papers will cover Drilling Statistics and Operations Research, Large-Hole Drilling, and New Practices in Drilling.

Kennecott Copper Corporation, through its exploration subsidiary **Bear Creek Mining Company,** is drilling an area southeast of Gunflint Lake near Ely, Minnesota. This drilling is a continuance of drilling undertaken near Loon Lake during the past two years, results of which have never been released. The firm was then looking for copper-nickel mineralization along margins of the Duluth Gabbro.

A long-term agreement has been reached between **Dow Chemical Company** of Midland, Michigan, and **Hydrometals, Inc.** of Chicago, Illinois. Under the agreement, "Hydro-T-Metal" will be fabricated at the large mills of **Dow Metal Products Company Division** at Madison, Illinois. Hydro-T-Metal is a new alloy of titanium, copper, and zinc which is said to retain all the basic advantages of zinc and provides, in addition, the structural strength, stability, and scope of other nonferrous metals. It is also reported to be the first zinc-based alloy that will not stretch or sag under tension or temperature change.

The **U.S. Bureau of Mines** has closed its district office at Joplin, Missouri and transferred its exploration and examination activities to Bartlesville, Oklahoma. The activities of the Joplin branch of the **Office of Minerals Exploration** have also been reassigned to offices in Denver, Colorado and Norris, Tennessee.

The **AEC** has transferred responsibility for the commercial distribution of boron-10 materials, enriched up to 92 percent in the isotope B-10, from its Chicago Operations Office to the Lockland, Ohio **Aircraft Reactors Operations Office.** The enriched boron to be distributed through Lockland is in the form of elemental boron and the compound postassium fluoborate. Boron enriched to greater than 92 percent B-10 may be obtained in small quantities from the Oak Ridge National Laboratory.

Lithium Corporation of America has decided to move its Minneapolis general offices to the east coast, and to move its St. Louis Park, Minnesota manufacturing facilities, research and development laboratories, and pilot plant to Bessemer City, North Carolina, where the company owns large ore reserves and operates a $7,000,000 lithium chemical plant. Production at St. Louis Park will end about October 15 and resume at Bessemer City around January 15. The new research and development laboratories are scheduled for completion in April 1960, while the general offices will move in June.

Tennessee Copper Company at Copperhill, Tennessee has started sinking its new Cherokee shaft to intersect the **School House** copper ore body. Only men and materials will be handled through the new shaft. All ore from the School House deposit will be trammed through a new 6,000-foot drift to the Central Shaft which is the main ore hoisting shaft at Copperhill.

The East Tennessee zinc district continues to expand as new properties are asquired. Most recent purchase has been the mineral rights to the 285-acre farm of J. C. Eubanks by **American Zinc Company of Tennessee.** Mr. Eubanks reports that American Zinc has been drilling prospect holes on the property for the last two years under terms of an option to purchase the mineral rights. According to Court House records, the purchase price was $35,731.25.

Foote Mineral Company is expanding its electrolytic manganese facilities at Knoxville, Tennessee by 30 percent. This is the second time in two years that the Loraine Street plant's capacity has been increased. Total cost to date has been about $3,000,000. The company has also broken ground for its new $2,200,000 research and engineering building near Exton, Pennsylvania. This will be an addition to the company's 53-acre Research and Engineering Center which has been under development since 1957.

Virginia-Carolina Chemical Corporation at Bartow, Florida has announced plans for building a $5,000,000 triple superphosphate plant at Nichols which will double present production at Nichols. Present output is 100,000 tons annually. The most important new features of the new plant are to be the provisions for better cleaning, elimination of air pollution, and improved working conditions. About $500,000 is to be spent on the anti-air pollution devices. V-C workers finally returned to their jobs in August after a 10-week strike. **American Cyanamid Company** and **Armour Agricultural Chemical Company** employees also ended their walkout.

The **International Nickel Company of Canada Ltd.** has agreed to cancel all remaining deliveries of nickel to the **General Services Administration's** stockpile and has also agreed that the nickel remaining deliverable under the company's "premium price" contract will be diverted into the market rather than the stockpile. The government will pay the company the difference between the market price and the contract price under the "premium price" contract, payment to be made in government-owned nickel oxide which is in excess supply.

Lithium Corporation of America Inc. has notified **Quebec Lithium Corporation** that the raw materials purchase contract between the two firms has been terminated. Lithium Corporation will not accept any further deliveries of spodumene ore concentrates from Quebec Lithium, and plans to resume mining of its own lithium-bearing property in North Carolina next year.

The **Office of Minerals Exploration** has issued a new pamphlet about the government's Minerals Exploration Plan. Under the program, the government will pay up to 50 percent of the cost of exploration which uses recognized and sound procedures, including standard geochemical and geophysical methods to obtain pertinent mineralogical and geological information.

The **Tennessee Copper Corporation** of Copperhill, Tennessee reportedly is planning to reopen the old **Silver Hill** lead, zinc, and silver mine at Lexington, North Carolina. A crew is now dewatering the 900-foot shaft, and then will retimber the old workings. The mine was once operated by the Confederate States of America to produce lead for bullets during the Civil War. Some surface mining was done from 1910 until 1913, but the work and air shafts have been closed since 1900. The property is leased from T. A. M. Stevenson and family of Winston-Salem.

The **General Services Administration** is offering several items for sale in about six months. Approximately 2,050 long tons of calcined alumina for which there is no stockpile requirement; and 1,500,000 pieces of partially processed quartz crystal in the form of slabs, wafers, and blanks are among these items. Contact the GSA, Washington 25, D.C., for further information.

Howe Sound Company has purchased the **Crucible Steel Casting Company** of Milwaukee and other related assets from the **Consolidated Foundries & Manufacturing Corporation.** Crucible produces all types of carbon and low alloy steel castings for the construction, manufacturing, and mining industries.

Battele Memorial Institute at Columbus, Ohio has prepared a new handbook for the **Rare Earth Research Group.** Entitled "The Properties of the Rare Earth Metals and Compounds," it brings together for the first time the most recently available data on the physical, crystal, chemical, mechanical, electrical, magnetic, nuclear, and thermodynamics properties of each of the 15 rare earth metals, as well as for yttrium, which is closely associated with the rare earths. A 114-item reference list of leading sources of information on rare earths is also included.

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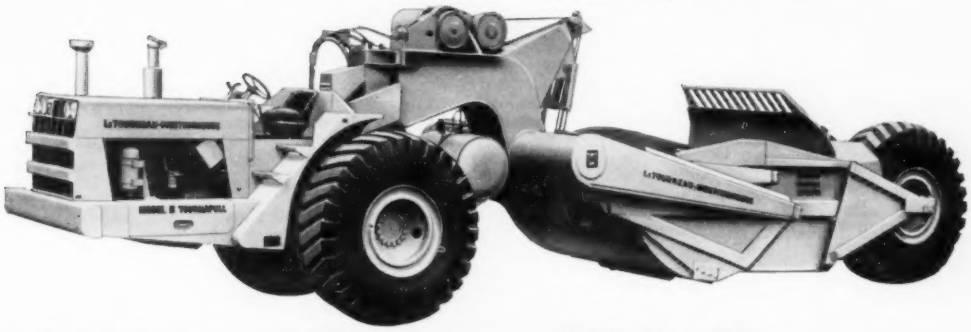
TOURNAPULL REAR-DUMPS: Available in 3 heavy-duty sizes for dependable off-road hauling. B Rear-Dump carries 35 tons (31.7 met. tons), choice of 335 hp Cummins or GM engines, with either sliding-gear transmission or torque converter. Top forward speeds to 34 mph (54.7 kph). C Rear-Dump has 22 ton (20 met. ton) capacity; 226 hp diesel engine with sliding-gear or constant-mesh transmission. Travel speeds are as high as 32.1 mph (51.6 kph). D Rear-Dump carries 11 tons (10 met. tons). Its engine is rated at 138 hp. Manual transmission is standard. Machine travels at forward speeds to 29.5 mph (47.4 kph).

TOURNAPULL SCRAPERS: Scrapers for Tournapull prime-movers are available in 3 sizes: B Fullpak, 28 yd^3 (21.4 m^3) capacity; C Fullpak, 18 yd^3 (13.7 m^3); and D Tournapull, 9 yd^3 (6.8 m^3). These scrapers are interchangeable with Rear-Dump, Bottom-Dump, Flatbed, or lift-and-carry Crane.



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C TOURNATRACTOR: This 218 hp, rubber-tired tractor travels anywhere under its own power, at speeds to 17.2 mph (27.6 kph) forward, and to 7.2 mph (11.5 kph) in reverse. Attachments include: dozer blade, Angledozer, root rake, push-block, power-control-unit, winch, side boom, tree stinger, rail coupler and snow plow. Tournatractor tows sheepsfoot rollers, scrapers, rooters and other equipment.

ADAMS MODEL MOTOR GRADERS: These are available in seven models, with hp from 60 to 190. Standard models of heavy-duty type have eight forward speeds to 26 mph (41.8 kph), four reverse speeds to 13 mph (20.9 kph). A gear assembly for three extra low speeds is optional. The POWER-Flow 660 has 190 hp engine with torque converter. It has forward speeds to 27.4 mph (44 kph). The LeTourneau-Westinghouse POWER-Flow 550 has 135 hp with torque converter. The handy 60 hp "220" has forward speeds to 18.3, reverse to 3.2 mph. Attachments for grader line include: snow plow, wing, "Snow-Blo" attachment for wing, scarifier, power-shift moldboard, bulldozer, rotary snow plow, and Jebco Elegrader (for sidecasting materials).

POWER-Flow, Tournapull, Tournatractor, Angledozer, Fullpak—Trademark Reg. U.S. Pat. Off.; Adams—Trademark LA-1796-M-1m

LW

LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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The manual sells for $10 and can be obtained from Battelle at 505 King Avenue, Columbus 1, Ohio.

Reynolds Metals Company of Richmond, Virginia is increasing its operations to 100 percent of capacity or 601,000 tons a year. Continued strong demand for additional aluminum in all market areas makes the step necesary, say company officials. The increases will add about 42,000 tons to the annual production rate. Affected are potlines in Lister Hill, Alabama and the Jones Mills smelters in Arkansas.

The Florida phosphate minerals and chemicals operations of **International Minerals and Chemical Corporation** have become a part of the new **Agricultural Chemicals Division.** The realignment combines three principal product divisions and was made "to capitalize on new opportunities in domestic and foreign markets." Floyd B. Bowen, production manager for phosphate minerals, will also take on the responsibilities of operations for consolidated minerals and chemicals in Florida and Tennessee. The new Agricultural Division combines the Potash and Phosphate Divisions. The latter had been organized last fall when the phosphate chemicals and minerals operations were combined. David J. Stark will be vice president in charge of operations in the new division.

American Metal Climax, Inc. will move its main offices to 1270 Americas Building, Avenue of the Americas, New York, New York, about March 1, 1960. The company and its divisions now have offices at 61 Broadway and 500 Fifth Avenue.

A new safety record has been set by **American Cyanamid Company's** Florida phosphate operations—more than 2,850,000 man hours without a disabling injury reports Arthur Crago, manager. The firm's **Sydney** open pit has worked over five years without a lost time accident. the **Orange Park** mine had no accidents in 1958. The last disabling injury as of May 1, 1959 was on June 24, 1957. Charles C. Hennessey, is safety director.

Union Carbide Metals Company, division of **Union Carbide Corporation,** has tripled the facilities of its fine metals and chemicals department in Niagara Falls, New York, to meet an increasing demand for high-purity (ductile) vanadium. Until recently, the division had been called the **Electro Metallurgical Company.** The name change is another step in the company's program initiated in 1957 which would identify all divisions more closely with the parent organization.

IRON RANGES

The strike of the **United Steelworkers of America** against the iron mining producers continues with little sign of a settlement in sight at this writing. **Zenith Mining Company** at Ely, Minnesota continues to operate through clearance with the union. The firm was recently organized and at the time of the strike had not been unionized. **Pittsburgh Pacific Company** at Hibbing has filed for an injunction against the union for stoppage of stockpile shipments. It had planned to load stockpiled ore from the Coons Pacific concentrator, but union pickets prevented the **Duluth, Missabe and Iron Range Railroad** from furnishing cars to the plant site. It is the contention of Pittsburgh Pacific that the union had no right to interfere with a common carrier railroad. Every indication points to increased operations by all mining companies upon settlement of the steel strike, but there will be little time left for shipping since the normal winter deadline is November 15.

Iron ore shipments from the United States ports of the Lake Superior district up to July 14, the date of the strike, totaled 33,894,268 gross tons, compared with 20,987,778 gross tons through July 1958.

The **Oliver Iron Mining Division** of **U.S. Steel Corporation** has refused to allow representatives of the **Iron Range Resources and Rehabilitation Commission** access to its land in order to conduct exploratory drilling to measure iron ore reserves. The IRRC says that the agency had only been drilling lands on which it has easements or where it owns surface rights for the past year and a half, and that the move to drill Oliver land is expected to become the basis for a court test on the state's rights. Many have been advocating that the state itself undertake test drilling to obtain its own data on iron ore reserves for tax purposes.

M. A. Hanna Company has ordered about a dozen two-story homes on its property near Iron River, Michigan, moved by November 1. The homes are being threatened by approaching surface and underground operations of the company's **Hiawatha** mine.

Research in iron ore beneficiation, in blast-furnace and direct-reduction processes, and in mining methods will be conducted by the **U.S. Bureau of Mines** during the fiscal year 1960 which began July 1. The work is designed to develop methods that will permit profitable operation of domestic ore deposits, despite growing competition from foreign iron-ore mining operations.

The **Pioneer** open-pit iron ore mine of **Oliver Iron Mining Division, U.S. Steel Corporation** won a "Sentinels of Safety" award for operating 713,118 man-hours without a disabling injury. This is the first time Pioneer mine has taken top honors in the National Safety competition. It was judged in the Metal Mines (Underground) category. The **Grand Rapids** mine of **Bestwall Gypsum Company** in Grand Rapids, Michigan won in the Nonmetallic Mines (Underground) category for 220,111 man-hours without a disabling injury. In the Open Pit Mines category, **Erie Commercial Mining Pit** of **Erie Mining Company (Pickands Mather & Co.)** at Hoyt Lakes, Minnesota won for operating nearly 1,250,000 man-hours without a disabling injury.

Caterpillar Strips Florida Fuller's Earth Pit

This is one of five pits currently being mined by the Floridin Company, which maintains one of the country's most modern fuller's earth mining and processing operations at Quincy and Jamieson, Florida. Floridin strips its open-pit mine with a D-7 Caterpillar tractor, and considers it profitable to mine an area if the overburden does not exceed 10 feet for each foot of clay in the deposit. Deposits may vary in size up to many acres in area, reaching a maximum thickness of about 15 feet. Average depth of deposits found in the Quincy area is approximately eight feet. Overburden consists mostly of sandy clay and sand rock, but deposits are overlain in some areas with hard sandrock that must be drilled or shot. After stripping the deposit, a dragline loads the fuller's earth into Floridin's fleet of seven dump trucks for transportation to the processing plant. The white, lightweight, absorptive clay was probably formed during the Miocene Age from the weathering and altering of crystalline rocks from the highlands north of the known deposits. Transported by water, microscopic particles were deposited on the old Florida Peninsula during the accumulation of coastal plain sediments. Most of the clay requires only minimum refining, but the natural moisture content must be reduced from its approximate 50 percent to a content not in excess of six percent. At the present rate of development, company officials expect known reserves to last for at least another hundred years.

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precipitates—NORTHWEST

IDAHO

A 1,000-foot drill hole is being put down from the surface at the **Abot Mining Company** property near Mullan, Shoshone County, Idaho to probe the Pilot Silver vein at depth. Additional holes will be drilled if results merit. The work is being done under a $43,550 lead-zinc-copper contract with the Office of Mineral Exploration. Rollin Farmin of Wallace is mine manager for Abot, which is controlled by **Day Mines, Inc.** of Wallace.

Development of the footwall Chester vein from the 3100 level down to the 4000 level in the eastern part of the **Sunshine** mine, Shoshone County, Idaho is yielding silver ore of better-than-mine-average grade. **Sunshine Mining Company** production in the first half of this year averaged more than 19,000 tons a month.

Several new showings of thorite have been uncovered in surface bulldozing at the Hall Mountain properties of **Northwest Prospecting and Development Company,** Boundary County, Idaho. New ladders have been installed in the leased **Golden Scepter** mine. Clarence Sheldon, Spokane, is secretary.

The old **Gold Back** mine, near Murray, Shoshone County, Idaho, an early-day producer, has been acquired under lease and bond by **Hypotheek Mining & Milling Company.** Direct smelter shipments from a small stope of oxide ore is planned to finance purchase of a mill to handle sulphide ore. John Kingsbury, Wallace, is Hypotheek president.

At the **Conjecture** silver-lead mine in Bonner County, Idaho's Lakeview mining district, crews of the operating **Federal Uranium Corporation** are working on a three-shift, six-day week until about November 1, when drifting on the new 1,000-foot level and raising from this level to the 700-foot level will be complete. Operations will then be cut to one shift during the winter to do development work. If enough ore is developed, plans call for construction of a mill next spring.

Dedication ceremonies were held in September for the new $16,00,000 phosphate plant of **Central Farmers Fertilizer Company** near Montpelier, Idaho.

Silver ore averaging 60 ounces per ton over a three-foot width has been exposed in the last 120 feet of an exploration raise driven in the Yankee Girl area of the **Metropolitan Mines** property, Shoshone County, Idaho. The raise was made by the operating **Sunshine Mining Company** from its 3,400-foot level to the 3,100-foot level. John T. Kingsbury of Wallace is president of Metropolitan.

Six, five-piece, concrete, experimental drift sets designed by the **United States Bureau of Mines** have been installed in "heavy" ground on the 2,770-foot level of the **Page** lead-zinc mine near Kellogg, Shoshone County, Idaho. The mine is owned and operated by **American Smelting and Refining Company.**

The **L. & L. Mines** property north of Dixie, Grangeville district, Idaho, has been sold by Ernest Wagner of Lewiston to Arthur Roehm, Harrah, Washington, who plans extensive exploration work.

MONTANA

The **Hidden Hand** group of claims near Deer Lodge in Powell County, Montana is the scene of a new lead-zinc exploration project by Howard C. Banks of Anaconda. The work has been approved by the **Office of Minerals Exploration, Department of the Interior,** which will put up half the $13,900 cost. Drifting and drilling are planned.

A $22,930 lead-zinc-copper exploration project has been undertaken at the **Baltimore** mine in Jefferson County, Montana, by **Baltimore Syndicate, Ltd.** C. M. Wagner of Heppner, Oregon, signed the **Office of Minerals Exploration** contract as general partner. A contract has been let with the **Bell Bros.** of Helena, Montana for 1,200 feet of diamond core drilling, from two different stations in the Hope Tunnel (600 and 800 feet, respectively, from the portal) to intersect projected ore zones. This is the first stage. If successful, the second stage will consist of approximately 400 feet of crosscutting and drifting to explore ore occurrences indicated by the drilling.

Trenches up to 20 feet in depth have been bulldozed at the **Jack Pine** phosphate lease near Elliston, Powell County, Montana, by the **Bunker Hill Company,** big Idaho lead-silver-zinc producer which is considering erection of a sulfuric acid plant. Diamond drilling will come next. Ray Horsman is project engineer.

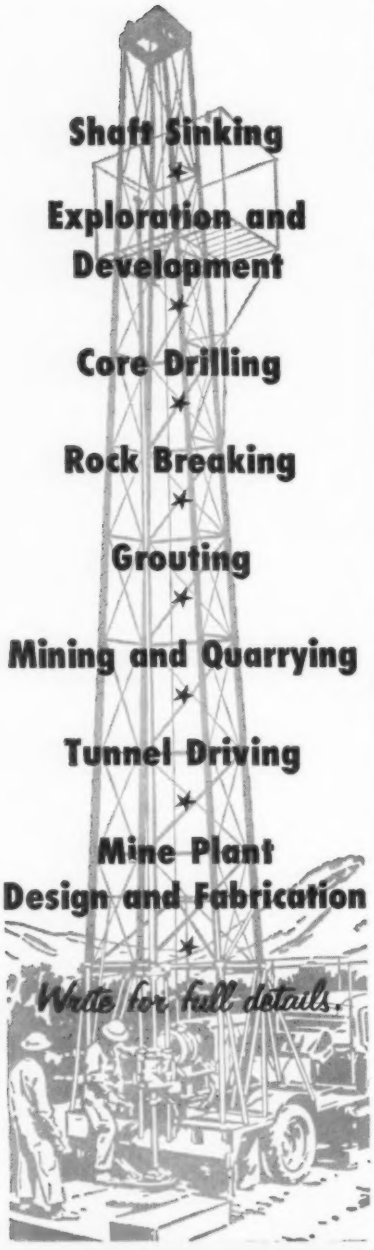
Sawyer Petroleum Company has shipped an acceptable tonnage of its new high-grade thorium chemical product, assaying around 30 percent thorium oxide, to the **Lindsay Chemical Division** of **American Potash & Chemical Corporation.** The firm believes that its recently perfected chemical process for producing this high-grade product is a "technical break-through" which greatly improves the company's market situation. Sawyer owns what is considered to be one of the largest known thorite deposit on the North American Continent. The mine is in the Lemhi Pass area of Montana. To date about 750,000 tons of ore have been developed.

A. E. Nugent and R. J. Horsman of the geological and engineering departments of **Bunker Hill Company** reportedly have established headquarters in Elliston, Montana to study the possibilities of developing a phosphate mining operation for their firm. Some trenching has been done with good exposures of phosphate reported.

Electric power has been brought to the **Yogo** sapphire mine near Lewiston, Montana, being operated by **New Mine Sapphire Syndicate** of Billings. Until now, power had been supplied by gasoline motors. Complete mechanization of the

New Utahcan Concentrator To Operate Year Round

Utahcan Mines Inc.'s new 150-ton lead-zinc-silver-gold concentrator is in operation at its property in the Jim Creek district, seven miles northwest of Ione, Idaho. Ore is mined under contract by Boys, Singer and Ableman from the firm's open-pit mine a half mile from the mill. The ore is brought to the mill by trucks which back into the building at right of picture and dump into ore bin. The middle building houses the crushing plant and fine ore bin. Lower building at left is grinding, classifying, and flotation section. Concentrates are trucked to the Bunker Hill Company's smelter at Kellogg for smelting and refining. L. L. Lorang is company president; Carl George is plant supervisor.



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mining operation is now expected which should increase production rapidly. Until 1958 the property had been shutdown for almost 30 years. Then, exploration work had recovered $20,000 in sapphires through the old sluice box method and from old dumps.

Francis Slaughtner of Deer Lodge, Montana has purchased 16 patented placer claims along the Ophir, Carpenter, and Three-Mile Creeks. The land totals 853 acres with six irrigation ditches, plus water rights. The properties were purchased from Clarence E. and George S. Kearney of California.

Three new geological publications are available from the **Montana Bureau of Mines and Geology**, Butte, Montana. They are the "Geology of the South Mocassin Mountains, Fergus County" by R. N. Millar ($1.00); "Geology of the Cherry Creek Area, Gravelly Range" by E. W. Heinrich and J. C. Rabbitt (open file at Montana School of Mines Library); and "Summary of Montana Mineral Resources" by U. M. Sahinen and Frank A. Crowley (free distribution).

OREGON

Wah Chang Corporation will install a second electron beam furnace in its plant at Albany, Oregon. The new furnace, also made by **Stauffer-Temescal Company**, will have a 225-kw rating as did the first unit. The furnace will be capable of melting and casting refractory metals in ingots five inches in diameter and 42 inches in length, and will be used to meet the mounting demand for these high-melting corrosion resistant metals in missile and nuclear industries. Electron beam melting makes possible the casting of ingots of high purity tungsten, tantalum, columbium, beryllium, molybdenum, vanadium and their alloys; metals whose melting points range between 4,000 to 6,000° F.

A small flotation mill has been built in Baker County's Rock Creek district of Oregon to process molybdenite-copper ore developed by W. W. Sirrine and W. W. Decker of Salt Lake City, Utah, and Robert Hulin of Baker. Considerable bulldozer work has been done and a road from mine to mill has been completed. The mine is now in production.

The **Ward Hill** lease on the **Columbia, E. & E., Tabor,** and **North Pole** lode gold properties in the Cracker Creek Mining District, Baker County, Oregon has been acquired by T. D. French of Wallace, Idaho, and by Harold and Henry Franz of Ritzville and Lind, Washington. A crew is at work on the **Columbia** property and contracted with Burl Fowler of Republic, Washington to do the ore hauling.

Two new quicksilver discoveries in Baker County, Oergon are being tested by bulldozer trenching and pitting. One of the finds, 2½ miles northwest of Hereford in Wood Gulch, is owned by James Anderson, James Dickerson, Albert Smith, and Jack Pitman. The other, in the Cave Creek area, is owned by Robert Hulin and Carl Bowman, both of Baker.

A hydraulic placer operation is being carried out in the Cracker Creek channel below Bourne, Baker County, Oregon, by F. A. Ramsey, A. M. Rowe, and associates of Sumpter. A large tree is topped, and three guy wires and block with tree shoes attached to the top to serve as a high line pole. A slusher, built like a rake with teeth eight inches apart, and a TD 14 International tractor with Carco drums drag the oversize gravel out and drop it as a 7-inch giant hydraulic cuts it loose. A bulldozer is also used to remove trees and brush. A sluice box with steel receiver is used to recover gold.

WASHINGTON

Triton Mining Company has been carrying on work at three northeastern Washington properties. A new road has been built to the **Kelly Camp** tungsten mine in Ferry County, where values in platinum and gold have been found. Bulldozer stripping was under way at last report and an ore bin was under construction. Surveying was being done at the old **Schumaker** silver-lead-zinc mine on Joe Creek, Stevens County, and rehabilitation at the **Pioneer** lead-zinc-silver mine, Stevens County. Cline E. Tedrow, Spokane consulting engineer, was directing work. Darrell A. Newland, Colville, is company president.

A growing interest in Pacific Northwest iron ore deposits has brought several applications to lease the **Big Iron** mine near Orient in northwestern Stevens County, Washington. A decision is expected to be made soon. The mine was located about 1895 and yielded 40,000 tons of iron oxide prior to 1937. Dewey J. Murrow, Spokane contractor, is president of **Big Iron Mining Company** and controls the company along with his brother, Edward R. Murrow, internationally known commentator, who recently purchased the holdings of Judge W. Lon Johnson of Colville, Washington.

Work has been resumed at the old **Mohawk** silver-gold-copper-lead-zinc mine in the Conconully District, Okanogan County, Washington. Contractor A. L. Davidson is extending No. 3 tunnel to get under an oreshoot which yielded some production in No. 2 tunnel. C. J. Weller of Spokane and Republic, is directing operations for **Sunny Peak Mining Company.**

Bear Creek Uranium Company is producing about 300 tons of development ore monthly at its Mount Spokane district property in northern Spokane County, Washington. A 14-degree winze is being sunk from the bottom of a 100-foot shaft, and a western drift also is being driven from the shaft. Lateral work from the shaft totaled 425 feet, at last report. Oscar Herem of Elk, Washington is mine supervisor.

precipitates—ROCKY MOUNTAIN

Great Northern Finances Taconite-Lignite Study

A research program to determine the best method of using North Dakota's lignite reserves in order to produce an economically marketable iron concentrate from Minnesota's non-magnetic taconite is underway at the University of North Dakota. The Great Northern Railway is underwriting the cost as part of its program for natural resource development of the area it serves.

An earlier Railway contract with the University of Minnesota for development of a commercial process for recovering non-magnetic taconite is well under way. Metallurgists believe that heat and gases formed by controlled burning of lignite can be used to convert the hematite to magnetite which is then easily recovered by separators. This and many other processes are under investigation.

A. J. Haley, Great Northern's mineral research and development chief, is coordinating liaison between the universities and the lignite and mining industries.

The **Francis Mining and Milling Corporation** is producing ore from the old **Torpedo Eclipse, Ruby Trust,** and **Minnie "B"** mines near Ouray, Colorado. According to W. C. Francis, president, about 25 tons of gold, silver, lead, and zinc ores will be processed daily, and some metallurgical grade fluorspar will be processed when the milling equipment is installed. Negotiations are under way for purchase of flotation equipment.

John B. Riggs of Denver, Colorado has resumed drilling and drifting operations to evaluate copper and gold-bearing vein structures at Summitville, Colorado. The work is being conducted under a DMEA program started three years ago by Dr. Richard V. Gaines for **General Minerals Corporation.** Mr. Riggs purchased the General Minerals lease in 1958. Wallace Rogers of Golden is drill contractor. Summitville was a large gold and silver producer from 1872 until the World War II closures of 1942. A 750-ton cyanide mill is available but has been inactive for 17 years and so is in need of repair. A new Forest Service access road provides an all-weather route to South Fork, Colorado.

A crew have been busy all summer driving the 1,250-foot adit for **Rouville Mining Corporation** in the Red Mountain mining district near Silverton, Colorado. The original plan was to drive under the known ore bodies which would drain water from upper parts of the mine. This program is still being followed.

Shenandoah Limited plans to operate throughout the winter at its Silverton, Colorado properties. Snow covers are being built at the **Gold King Tunnel** and **Shenandoah** mine so that work can continue. The company also plans to do some extensive exploratory work on the **Argentine** some 800 feet below the main level of the Shenandoah mine.

Camp Bird Colorado, Inc. has stepped up its underground development program at the **Camp Bird** mine near Ouray, Colorado. An engineering and design contract has also been awarded to **Western-Knapp Engineering Company** for mill construction.

The **Continental Chief** silver-lead-zinc mine at the head of Iowa Gulch in the Leadville mining district of Colorado reportedly has been acquired by **Benson Mining & Leasing** of Tucson, Arizona. The new owners plan to allow split-check lessees to operate the property. The mine was first opened in 1884; last exploration work was done around 1931.

Lessees working the **Vanadium Queen** group of claims for **Green River Oil & Uranium Company** in San Miguel County, Colorado report they have encountered vanadium-uranium ore considered above average in grade and are now mining this area. The claims include the **Hot Spots 1-6, Civet Cats 1-6, Fraction No. 2, Last Chance, Pogos 1-4, Isotopes 1-6,** and **Bingos 1-5.**

Tri-State Petroleum & Minerals Inc. of Denver, Colorado and **Giant Resources Inc.** of Grand Junction, Colorado have signed a working agreement which provides that Tri-State will lease and mine the **Little Dora** property near Silverton. Giant Resources had closed the mine in the spring of 1958. Some 60,000 tons of gold-silver-lead-copper ore reportedly are blocked out. Tri-State will receive 90 per cent of the net profits and Giant Resources the remaining 10. Tri-State acquired two-thirds of the outstanding stock of **Argyle Mining and Milling Corporation** of Silverton.

The **U.S. Bureau of Mines** plans a 1,200- to 1,500-foot core drilling program in the Silverton area of Colorado to determine the rhodonite reserves. The exploration will take place at an altitude of 12,000 feet, and, with winter approaching, the work may have to be deferred until 1960. This is property of the **Sunnyside** mine, presently leased to **Shenandoah Limited.**

Domestic uranium ore reserves at the end of the first six months of 1959 totaled 88,900,000 tons, compared with 82,500,000 at the end of 1958. The AEC at Grand Junction, Colorado, also reported that ore production during the first half of 1959 was 3,310,000 short tons, up from 2,807,000 in the last half of 1958. Ore feed to processing mills was ahead of production, with the result that ore stockpiles declined. The Grand Junction depot purchased 8,298 tons of uranium concentrate in the first half of this year, and only 6,651 in the last half of 1958.

The **Uranium Reduction Company** has received an amended AEC contract which extends the purchase agreement for uranium concentrates to December 31, 1966, and provides for conversion of one acid circuit to a carbonate circuit capable of treating high-lime ores of the district. Uranium Reduction is already undertaking the $2,000,000 construction project, and it is scheduled for completion by January 1, 1960. The mill will continue to process about 1,500 tons of ore daily.

Bear Creek Mining Company has blocked out about 200,000 tons of silver-lead-zinc ore at its **Tintic Unit** in Utah. To mine the deposit, a production shaft will have to be sunk 300 feet deeper than the present Burgin exploration shaft. Bear Creek has been prospecting the Tintic Unit under a multimillion dollar arrangement with **Chief Consolidated, Tintic Standard,** and other mining companies in that area. Three ore zones were located earlier this year. (See MINING WORLD, July 1959, page 79.)

The **Escalante Mining Venture** near Enterprise, Utah, which **Armet Company** and **Chief Consolidated Mining Company** are associated with **Cerro de Pasco Corporation,** reportedly contains 350,000 tons of ore averaging 29 ounces silver per ton. Samuel S. Arentz of Armet Company had previously delineated this ore in his examination of the **Holt** property, as it was called. A shaft will be sunk but installation of pumps will first be necessary in order to unwater the area ahead of shaft sinking. Meanwhile, Chief Consolidated has decided not to reopen its **Chief No. 1** mine in the Eureka-Tintic district. The firm is presently engaged in a geological survey of the Clifton district in western Utah. **Shattuck Denn Mining Company** exercised its option on 100,000 shares of Chief Consolidated stock, and has to pay the balance in quarterly installments through 1961.

Uranium Reduction Company of Moab, Utah has made its first shipment of uranium concentrate to Japan. The company shipped about 660 pounds of U_3O_8 to **Mitsubishi Metal Mining Company** under an AEC export license. It is believed that the concentrates will be used in experimental production of natural uranium in reactors.

The **Atomic Energy Commission** has issued follow-up orders to operators of certain uranium processing mills in a further step to assure that concentrations of radioactive material in mill areas and in wastes discharged into streams are brought within permissible limits established in Commission regulations. In Colorado, those plans affected are **Union Carbide Nuclear Company's** plant at Uravan; the Durango of **Vanadium Corporation of America;** and the Maybell mill of **Trace Elements Corporation.** In Utah, the plants affected are Union Carbide's Green River operation, and the Salt Lake City mill of **Vitro Uranium Company.** Plans for bringing their operations into compliance with regulations have been submitted by the mills. Under the new orders, performance in accordance with these plans is made a condition of the companies' licenses to possess and process uranium ores. The Commission will inspect the mills to determine whether adequate measures have been taken.

Utah Construction Company has changed its name to **Utah Construction & Mining Company,** which will more fully describe the company's activities

since it has so many mining operations throughout the world. Meeting in Salt Lake, stockholders also voted to eliminate present stockholders' pre-emptive rights to purchase any additional stock, and to increase stock capitalization. This action is expected to make stock available to meet business needs as they arise and will be issued as required.

WYOMING

Lucky Mc Uranium Corporation has exercised an option on uranium property of **Green River Oil & Uranium Company** in the Gas Hills area of Wyoming, and will mine the property under an arrangement with Green River. Lucky Mc must start actual mining on or before November 1, and continuously mine not less than the AEC allotment or any increase made thereto by future amendment, provided such ore exists on the claims. Advance royalties of $17,000 have already been paid, as well as a cash bonus of $60,000. Some 120 acres of claims currently involved in litigation over title have been taken over by Lucky Mc who will now assume responsibility for legal prosecution on a cost participating basis.

Susquehanna-Western Corporation's uranium mill at Riverton, Wyoming was formally dedicated in August. The 600-ton mill has been in operation since November 1958. It was built at a cost of $5,000,000 and includes a sulphuric acid plant with a capacity of 100 tons per day. Highlight of the dedication ceremony was a speech by N. W. Richards, nuclear engineer with Pacific Power and Light Company, who predicted that atomic power that would be cheaper than with present fuels might be produced within 10 years.

Some 2,000 square miles in the Green River area of Wyoming are being explored by various chemical firms seeking commercial deposits of trona (soda ash). The companies are attracted by the successes of **Intermountain Chemical Company,** a joint affiliate of **National Distillers and Chemical Corporation** and **Food Machinery and Chemical Corporation. Diamond Alkali Company** has been active in the area for more than a year, core drilling for trona deposits. **Stauffer Chemical Corporation** recently was reported prospecting in the area. A third firm, an affiliate of **Ruby Chemical Corporation** of California, is reported exploring in the western sector of Sweetwater County, while a Texas group has been active in the area immediately south of Green River.

A $715,000 loan has been approved for Hot Springs REA to finance construction of lines and substations for the **Globe Mining Company's** mill and also the Shirley Basin mining operations of **Utah Construction Company.** Part of the money will be for general system improvement in the Gas Hills area. The Shirley Basin area will get 30 miles of new transmission line, the first high line in this uranium district. Already under constructon is a new substation for the **Federal-Radorock—Gas Hills Partners'** mill.

Balboa Mining and Development Corporation, operating 20 miles north of Moorcroft, Wyoming, is presently sinking a 300-foot inclined shaft, and plans to drive 500 feet of drift from the bottom. Albert Stoich is president of the uranium firm.

Results of a reconnaissance investigation of uranium occurrences in the Saratoga area of Carbon County, Wyoming have been released by the **Department of the Interior.** The work was done on behalf of the **United States Atomic Energy Commission** by the **United States Geological Survey.** The Saratoga area includes about 210 square miles in south-central Wyoming where rocks of Precambrian Paleozoic, Mesozoic, and Tertiary ages are exposed. No commercial deposits have been found to date. The highest concentration of uranium (0.027 percent) was found in chert layers and irregular masses in silicified limestone. Carnotite the only uranium mineral identified in the area, is believed to have been formed by a solution and redeposition of uranium by ground water. The report is Bulletin 1046-M, by James G. Stephens and M. J. Bergin, and may be purchased for 55¢ from the Superintendent of Documents, Washington 25, D.C.

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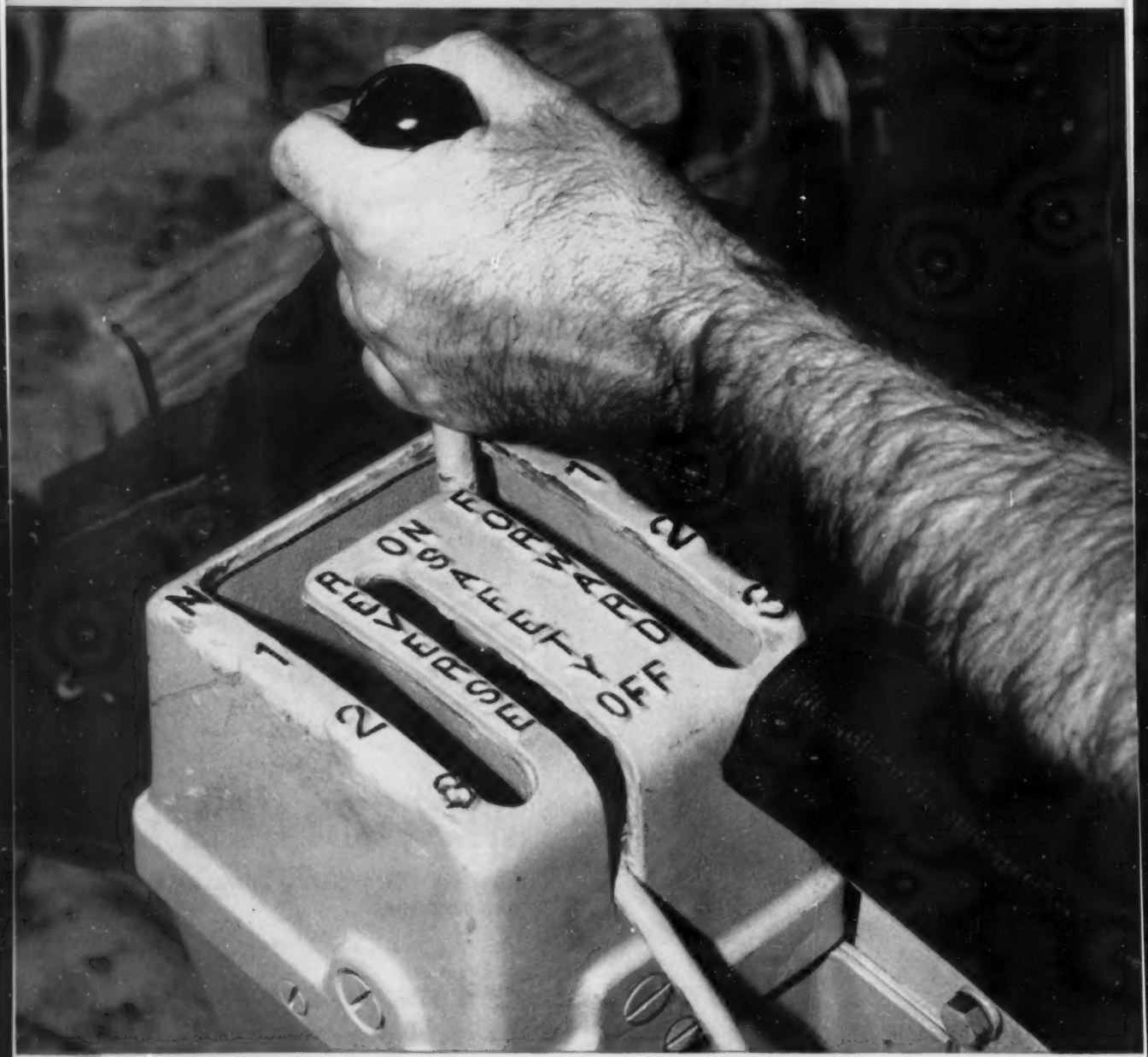

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DIESEL ENGINES • TRACTORS • MOTOR GRADERS

EARTHMOVING EQUIPMENT

BORN OF RESEARCH
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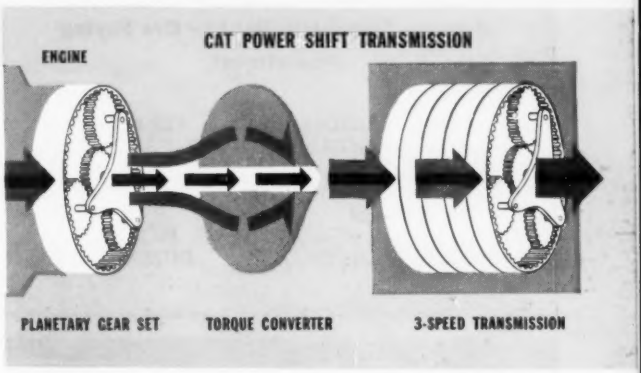
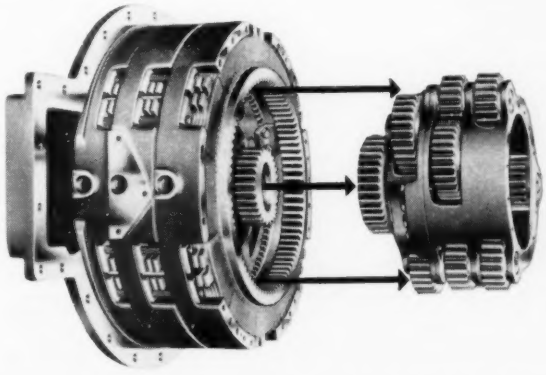


BASIC DESIGN: Total power is transmitted from the engine to a planetary gear arrangement mounted in the engine flywheel. The planetary divides and directs the total power—part goes through a direct drive shaft straight to the transmission and the remainder through a torque converter to the transmission. This enables the Cat power shift transmission to combine the snap and positive operating feel of direct drive with the anti-stall and flexibility features of torque converter drive. Its clean, unit construction design makes it easy to service, when required.



ONE TON OF RUGGEDNESS: Here's a portion of the components that make up the new Cat power shift transmission. Designed and built specifically by Caterpillar for its giant tractors, this rugged transmission weighs well over a ton. Every component is constructed for long-lived service. Selected alloy steel insures a transmission that stands up under the toughest conditions. Equally important, Cat power shift transmission comes to you thoroughly tested by exacting design and demanding field work in the heaviest earthmoving duty.

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Metal & Mineral Prices

U.S.A.

METALS

September 14, 1959

COPPER: **Electrolytic.** Delivered F.o.b. cars, Valley basis (pound) ..... 30.00-31.50¢
Lake. Delivered, destinations, USA ..... 31.50¢
Foreign. Delivered, destinations, USA ..... 31.50¢
Custom ..... 33.00¢
LEAD: **Common Grade.** New York (Per pound) ..... 13.00¢
Tri-State Concentrate, 80% lead, per ton $156.12
ZINC: **Prime Western:** F.o.b. E. St. St. Louis (Per pound) ..... 11.00¢
Prime Western: Delivered New York ..... 11.50¢
Tri-State Concentrate, 60% zinc, per ton $64.00
ALUMINUM: **Primary 30 Pound Ingots (99% plus)** (Per pound) 26.80¢
ANTIMONY: **Lone Star Brand. F.o.b. Laredo, in bulk** (Per pound) 29.50¢
BISMUTH: (In ton lots) price per pound $2.25
CADMIUM: **Sticks and bars.** 1 to 5 ton lots Price per pound 1.30
COBALT: **97.99%,** keg of 550 pounds (Price per pound) $1.75
COLUMBIUM: **Powder** ..... Nom., per pound $55.00-$85.00
GERMANIUM: dioxide, high purity, gram ..... 18.50¢
LITHIUM: **98%** (per pound) ..... $9.00-$12.00
MAGNESIUM: **Ingots (99.8%)** F.o.b. Velasco, Texas, per pound 36.00¢
MERCURY: **Flasks.** Small lots, New York ..... $223.00-$225.00
NICKEL: **"F" Ingots (5 pounds).** F.o.b. Port Colbourne, Ontario 75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay $30.00 to $40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram $30.00
SELENIUM: **99.5%, per pound** $7.00
TELLURIUM: Common grade, Per pound $2.50
THORIUM: per kilogram $43.00
TIN: **Grade A Brands.** New York (Per Pound) Prompt delivery $102.375
TITANIUM: **93.3%** + Grade A-1 Sponge (Per pound) ... $1.50-$1.60
URANIUM: **Rod** (0.790 U-235) $16.00 Per Pound; Foil $16.75
U-235: **Nominal** (Per pound) $7,725
GOLD: **United States Treasury Price** ..... $35.00 per ounce
SILVER: **Newly mined domestic.** U.S. Treasury price per ounce 90.5¢
Foreign Handy Harmon ..... 91⅜¢
PLATINUM: Per ounce ..... $77.00-$80.00
ZIRCONIUM: **Sponge,** Per pound, Reactor Grade $5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: **10 to 12% BeO.** F.o.b. mine, Colorado $46.00 per unit Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $48.00.
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons,
African (Rhodesian). 48% CR_2O_3. 3 to 1 Ratio .... $40.00-$42.00
African (Transvaal). 48% Cr_2O_3. No ratio ..... $28.00-$30.00
Turkish, 48% CR_2O_3. 3 to 1 chrome-iron ratio .. Nominal $45.00
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal $1.00
IRON ORE: **Lake Superior. Per gross ton Lower Lake Ports**
Mesabi, Non Bessemer, 51.5% Fe $11.45
Mesabi, Bessemer, 51.5% Fe $11.60
Old Range Non Bessemer $11.70
Old Range Bessemer $11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit 25.00¢
MANGANESE ORE: **Metallurgical grade.** 48 to 50% Mn Long ton unit ..... $1.00-$1.05
Metallurgical grade. 46 to 48% Mn. Long ton unit. .. $0.95-$1.00
Metallurgical grade. 44 to 46% Mn. Long ton unit .. $0.85-$0.90
Domestic U.S. Government. GSA Basis $2.30 per unit for 48% mn.
MOLYBDENITE CONCENTRATE: **90% MoS_2 F.o.b.** Climax, Colorado. Per pound Mo, plus container cost $1.25
TUNGSTEN CONCENTRATE: **Domestic.** 60% WO_3 Per short ton unit ..... Nominal $24.00
Foreign: 65% WO_3 Per short ton unit (Scheelite) .. Nominal $17.00
Foreign: South American, Spanish, Portuguese .... Nominal $16.00
URANIUM ORE. F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is $1.50 per pound of U_3O_8 in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.

NON-METALLIC MINERALS

BARITE: Oil well drilling. Minimum **4.25 specific gravity,** per short ton $16.00
BENTONITE: **Minus-200mesh.** F.o.b. Wyoming. Per ton, carload lots $12.50
Oil Well grade. Packed in 100 pound paper bags $14.00
BORON: technical grade .. F.o.b. Boron California. Per ton $47.50
FLUORSPAR: **Metallurgical grade.** 72.5 % effective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines ... $37.00-$41.00
Mexican. 70% F.o.b. border ..... $26.00-$27.00
Acid Grade. 97% CaF_2, Bulk, F.o.b. mine ..... $45.00-$49.00
PERLITE: **Crude:** F.o.b. mine per short ton ..... $3.00 to $5.00
Plaster grades. Crushed and sized. F.o.b. plants .... $7.00 to $9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas $25.00
Export ..... $24.00-$25.00

London

September 14, 1959

Per Long Ton USA Equivalent cents per pound*

COPPER:	**Electrolytic spot**	£228	0s 0d	28.50¢
LEAD:	**Refined 99%**	£ 70	10s 0d	8.81¢
ZINC:	**Virgin, 98%**	£ 86	2s 6d	10.79¢
ALUMINUM:	**Ingot, 99.5%**	£180	0s 0d	22.50¢
ANTIMONY:	**Regulus, 99.6%**	£197	10s 0d	24.69¢
TIN:	**Standard, 99.75%** ...	£793	10s 0d	99.13¢
TUNGSTEN:	**Long ton unit**	165s		$23.10

***With Sterling Pound at $ 2.80**

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*

World-Wide Interest in Exploring By Air

Sponsorship of reconnaissance-type airborne geophysical surveys by national governments over their unexplored terrain is on the upswing. By providing basic magnetic maps to the mining industry, these countries hope to interest companies in developing their natural resources.

An example of this trend is the recent award to Aero Service Corporation of Philadelphia, Pennsylvania, of a larger aerial survey contract by the Kingdom of Morocco, followed by the Government of Turkey with a $1,000,000 contract for aerial magnetics. Aero Service and its affiliates have conducted airborne geophysical surveys on six continents during the past 12 months, logging nearly 200,000 square miles in their search for mineral deposits.

A survey in Venezuela, started late last year, calls for airborne magnetometer and scintillation counter studies over 10,500 square miles.

The Surinam survey, which began August 6, will require flying of more than 66,000 miles, over dense jungle in search of iron ore, copper, uranium, and other minerals. About 80 percent of the country (shaded area on map at right) will be covered by the study. Weather permitting, it will be completed in about one year.

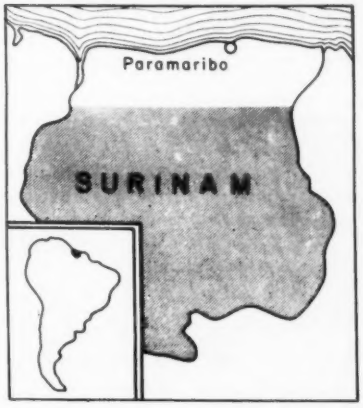
Survey areas were selected by Aero's photogeologists after intensive studies of air-photos covering the nation. Since there are no visual landmarks in Surinam, Aero will use a DC-3 equipped with Doppler navigator, like that pictured above which was pioneered over 100,000 miles of trackless North African desert last year. This highly accurate plane-positioning system operates without ground stations, photographs, or maps.

In the Far East, Aero crews explored more than 20,000 square miles in South Korea and Thailand earlier this year under ICA-financed contracts. Survey targets: iron ore and uranium.

A 16,000-square-mile airborne magnetometer-scintillation counter survey was made for the Federation of Malaya by Aero's affiliate, Canadian Aero Service Ltd. of Ottawa. Conducted under a Colombo Plan contract, preliminary results reflect the presence of strong radioactivity, as well as unknown iron and tin potentials.

Other Canadian Aero crews are busy on fixed wing and helicopter-borne surveys in Alaska, the Yukon, Northwest Territories, British Columbia, Saskatchewan, Ontario, and Quebec. They will fly over 50,000 square miles of electromagnetic, magnetometer, and scintillation counter surveys for government agencies, mining companies, and consulting firms during 1959.

In the United Kingdom, Canadian Aero is performing a 22,000-square-mile magnetometer survey for the Geological Survey and Museum of the Department of Scientific and Industrial Research. This project is part of a continuing program of regional geological and geophysical studies.



CUBA — With construction in final stages, **Freeport Nickel Company's** nickel-cobalt project is ready for production. Ore is already being mined and put through the slurry plant which prepares it for concentration. The hydrogen and hydrogen sulphide plants and the power plant are in operation. The sulphuric acid plant is ready for production. At Port Nickel, Louisiana where the nickel-cobalt sulphide concentrate will be received from Moa Bay, production of nickel and cobalt as briquetted or powdered metal will start about six weeks after Moa Bay is in full operation.

CHILE—Iron ore is expected to replace nitrate as one of Chile's major export items after 1960, and by 1965 iron ore exports are expected to bring in twice as much foreign exchange as nitrates. New mining companies, such as **Santa Fe, Santa Barbara,** and **Cerro Iman,** will be sharply increasing their operations over the next few years. The **El Laco** iron ore deposit of Santa Fe should be in production in 1963, increasing total exports by 4,000,000 tons in 1965. Chile's export volume in 1959 is estimated at about 4,880,000 metric tons. This is expected to rise to 5,608,000 in 1960, to 8,270,000 in 1963, and between 10,829,000 and 12,270,000 in 1965.

VENEZUELA—**Western Oil Fields Inc.** of Denver, Colorado, and its partner, **Trans-Western de Venezuela,** are rushing development of their 15,000-acre iron ore property in southern Venezuela. Called **El Trueno,** it is estimated to contain over 132,000,000 long tons of first- and second-grade ore. The property is near that of **U.S. Steel Corporation (Cerro Bolivar).** Western Oil Fields actually owns 50 percent of the stock of Trans-Western; Venezuelan nationals own 30 percent and the remainder is held by the government. **Minero Ferroviaria de Venezuela (Mivenca)** was then formed as operating company. It will receive 50 percent of the net profit from sale of iron ore in return for mining and transporting the ore. Thus, Western Oil will actually receive only 25 percent of the total profit. Current rates of production are set at 2,000,000 for the first year of full operation, 5,000,000 for the third year, and around 7,000,000 when at maximum capacity. Mivenca plans to build a railroad from El Trueno to the Orinoco River, where low-cost water transportation will then be available.

BOLIVIA—**Patino Mines & Enterprises Consolidated,** whose properties are being operated by the **Corporacion Minera de Bolivia** since confiscation by the Bolivian government in 1952, estimates that it received $271,500 in the first half of 1959 in retention funds (after net estimated expenses). This is in accordance with an agreement signed in 1956 for indemnification for the value of the property. In the first six months of 1958, the firm reported retentions totaling $257,754, after expenses. In 1959 the company also received $63,227 on the sale of the balance of its share in **Bolivian Tin & Tungsten Mines Corporation.**

BRAZIL—The **Companhia Siderurgica Mannesmann** plans to double its steel production at Belo Horizonte, State of Minas Gerais, and to install equipment which

will increase production of cold rolled material. (See MINING WORLD, July 1959, page 82.)

BOLIVIA—**Natomas Company** which holds controlling interest in **Bol-Inca Mining Corporation,** has given up its placer gold exploration work on eastern Bolivian streams. The subsidiary firm had been exploring along the banks of the Mapiri, Kaka, and Guanay rivers.

JAMAICA—**Alumina Jamaica** hopes to have its £6,000,000 plant completed by the end of the year. However, it will take another two years to bring it into full production capacity of about 250,000 tons of alumina annually. This is the second plant Alumina has built in Jamaica; the newest one is located at Ewarton, about 50 miles from the initial plant.

BOLIVIA—The Bolivian government has decided to close the **Pulacayo** mine near Uyuni, once operated by **Cia. Huanchaca de Bolivia.** This was an important silver producer in its early days of operation, and later also yielded lead and zinc. One reason for the closure is that to continue mining activities will require a yearly subsidy of about $200,000.

BOLIVIA—The joint venture of two Japanese firms for development of the **Chacarilla** copper mine is well underway and production has started. The firms are **Nitto Metal Mining Company** and **Dowa Mining Company.** They plan to produce 1,000 tons of copper concentrates in first three months of operation. The property is located near the Bolivian-Chile border, and on the La Paz-Arica railroad. All shipments will go to Japan.

COLOMBIA—The country's first zinc smelter has gone into operation at Bogota. Operated by **Metales y Productos Afines,** it will produce 2,500 tons of zinc annually, and some zinc oxide. Ore will come from mines at Junin, about 30 miles east of Bogota.

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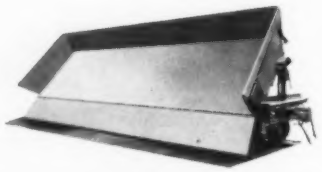
Safe side dumping eliminates expensive labor and crane equipment. Completely smooth interiors permit full dumping—no "dead load" returns!



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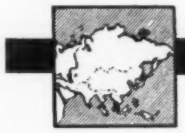


ASIA

INDIA—**Hindustan Aluminium Corporation** has been formed by **Kaiser Aluminum & Chemical Corporation** of Oakland, California, and the **Birla** interests in India. The joint venture will build and operate a 20,000 metric-ton aluminum production plant at Rihand in Uttar Pradesh Province, together with related bauxite and alumina facilities. Total cost of the project is estimated at $3,000,000. Kaiser will hold about 27 percent of the shares; the remainder will be held by Birla and the general investing Indian public. Hindustan Aluminium has already applied to the **Export-Import Bank** for long-term dollar and rupee loans amounting to $15,750,000. **Kaiser Engineers Division** of **Henry J. Kaiser Company** will build the facilities. Operation is scheduled for 1962. Bauxite will come from the Amarkantak area.

MALAYA—**Malayan Tin Dredging** Ltd.'s new £1,000,000 dredge has gone into operation on the **Kampong Gajah** property. This is a deep digging dredge which can go down to 130 feet. Reserves remaining in the Kampong Gajah property are estimated at 368,000,000 cubic yards, and should give the firm another 35 years of mining life.

JAPAN—The **Japan Atomic Fuel Corporation** has started production of metallic uranium from domestically mined ore. The refinery hopes to process 300 tons of ore into 180 kilograms of yellow cake or semi-refined metallic uranium during fiscal 1959. If work progresses as scheduled, the first domestic "yellow cake" will be produced by the end of the year. Data from this project will be used to determine the scale of the uranium ore refining facilities which will be set up at Ningyo Pass and at other uranium mines. The ore from the first processing is coming from Ningyo Pass on the borders of Okayama and Tottori Prefectures.

INDIA—Extensive deposits of fluorite have been located in Durgapur District of Rajasthan state. Reserves are estimated at about 1,500,000 tons containing about 22 percent fluorite. Prospecting is continuing.

SOUTH KOREA—The **Korea Mining Association** has requested the **Ministry of Commerce and Industry** to subsidize the exporting of minerals to areas other than Japan, and to purchase surplus minerals directly. Since suspension of trade

with Japan, the association feels these measures are needed: approval for importing of popular items with proceeds from exporting of minerals; government foreign exchange be loaned on security of L/C's opened for exporting of minerals to other than Japan; ocean freight rates either be reduced or subsidized by the government; and HW 4,110,000,000 be set aside for purchasing of surplus minerals by the government.

EGYPT—Fissionable materials, including uranium, reportedly have been found on the Sinai Peninsula. A survey from the United Arab Republic's **Atomic Energy Commission** will assess the discovery.

THAILAND—The **International Atomic Energy Agency** of the United Nations has approved technical assistance funds for use in Thailand. The country will receive the services of experts in the fields of prospecting, analysis of nuclear raw materials, and nuclear instrumentation, as well as a health physicist and two specialists in use of radioisotopes in agriculture and medicine.

PAKISTAN—According to the chairman of the **Pakistan Industrial Development Corporation,** the iron ore found in Waziristan is of high grade and is superior to that of the Kalabagh iron ore deposit. Development of the area is slated to start soon. Arrangements are being made with the tribal maliks in the area, and a geological survey team will move into the area as soon as these agreements have been completed. A survey of the Kalabagh area is still continuing but results have not been too satisfactory. This area was supposed to supply ore for the proposed steel plant at Multan.

IRAN—Several new chrome deposits reportedly have been discovered in the Shiraz region of southeastern Iran. The district is expected to attract the interest of foreign firms.

SOUTH KOREA—The **Mining Bureau** of the **Ministry of Commerce and Industry** is promoting a plan to test drill alluvial mines. Initially, the alluvial gold mine held by the **Yongwang Industrial Company** and the **Songnam** mine will be drilled with equipment purchased with UNKRA funds.

NORTH AMERICA

BRITISH COLUMBIA—**Rio Tinto Canadian Exploration** has taken a working option on a 100-claim property in Highland Valley from **Trojan Consolidated Mines.** Rio Tinto is to complete a minimum of 2,000 feet of drilling by March 30, 1960 in order to obtain a second option to May 30, 1961. During the latter period, the firm may decide to take a 99-year lease, or pay Trojan $1,000 per month, or spend not less than $12,000 on exploration over the 12-month period. If the property is not brought into production within five years, Rio Tinto is to pay Trojan $25,000 yearly until production starts or cancel the lease. In the past, Trojan had sunk an exploration shaft to investigate the main zone at the 150-foot horizon. This work indicated ore averaging 2.01 percent Cu.

ONTARIO—The Dutch firm of **N. V. Billiton Maatschappij** has taken a lease on molybdenite property held by **Lindsay Explorations** in the Port Arthur area. Billiton is to spend at least $30,000 on exploration by the end of October 1959. Further extension of the lease until December 31, 1959 would require expenditure of $40,000. A loan to Lindsay of $19,000 and payment of $5,000 would further extend the period to March 31, 1960, and $111,000 before October 31, 1960 would be required to extend it again. Lindsay can then require Billiton to bring the property into production at a minimum rate of 100 tons per day. If this last stage is reached, a new company will be formed.

QUEBEC—**Consolidated Zinc Corporation of Canada** is considering plans for sinking a three-compartment shaft to about 800 feet on its **Consolidated Vauze Mines** property north of Noranda. Some 80,000 tons of ore averaging 6.5 percent copper and 4.5 percent zinc, with values in gold and silver, is estimated on the property. Copper values have also been found by surface drilling.

BRITISH COLUMBIA—At the **Duncan** lead-zinc prospect on the east side of Duncan Lake, **Consolidated Mining and Smelting Company of Canada** has 20 men doing underground work to check on surface drilling and geological work done last year. A contract has been awarded for a seven-mile access road. J. J. McKay is in charge.

MANITOBA — Work is progressing rapidly on developing **Hudson Bay Mining and Smelting Company's** new mines at Snow Lake. Laying of track for the 52-mile spur has already started and it may be ready for use by June. The mines will ship 1,500 tons of ore daily, starting probably next summer; 1,000 tons of zinc ore will come from the **Chisel Lake,** and 500 tons of copper ore from the **Stall Lake.** The property is located about 70 miles east of Flin Flon.

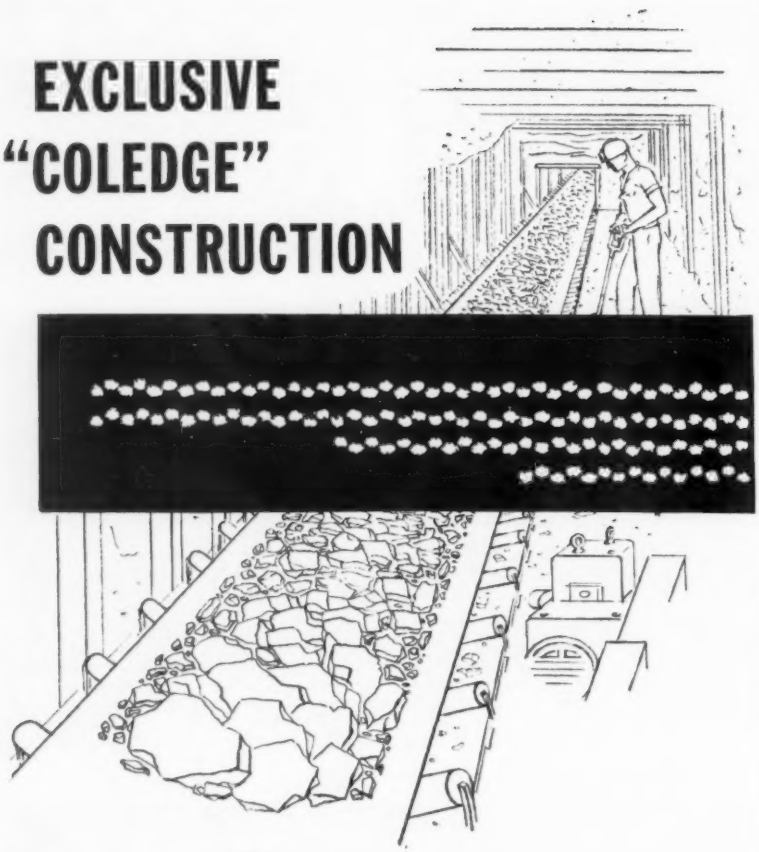
ONTARIO—**Geco Mines Ltd.** expects to have its No. 2 primary crusher completely installed by the end of October. The No. 3 shaft is being sunk to 2,520 feet and is more than half finished. The firm is also building 60 new houses at its Manitouwadge townsite. For the first six months of this year, the company reports that it milled 633,733 tons of copper-zinc-silver ore.

ALBERTA — The new metallurgical process for treatment of zinc sulphides developed by **Sherritt Gordon Mines** at its Fort Saskatchewan refinery is attracting the attention of **Noranda Mines.** Sherritt Gordon is experimenting with Noranda's ore in laboratory testing at Fort Saskatchewan and will undertake pilot plant testing if results are encouraging. Professor Frank A. Forward actually discovered and tested the new process. It involves direct leaching of zinc sulphides under oxidizing conditions at low tem-

Cominco Taps Pyrite Tailings Pond for Iron

An estimated 15,000,000 tons of recoverable iron ore lies in the big pyrite tailings pond beyond the Sullivan concentrator shown in the center of this aerial view of Consolidated Mining and Smelting Company's operation at Kimberley, British Columbia. Cominco plans to recover this for use in its proposed $20,000,000 iron and steel plant (see MINING WORLD, June 1959, page 92). First contracts have now been awarded. A West German firm, Lurgi Gesellschaft of Frankfurt, will supply the sintering equipment, and a Norwegian company, Elektrokemisk of Oslo, will provide the electric pig iron furnace. The European firm did the final test work for the electrothermic reduction process which will be instituted for the first time in North America. Foundation Company of Canada, Ltd. has the major construction contract, including erection of buildings and installation of equipment. Cominco's own engineering division will design the plant which will have a capacity of more than 100,000 tons of pig iron, steel ingots, and rolled steel products annually.

EXCLUSIVE "COLEDGE" CONSTRUCTION



Quaker Thermoid gives Thermoid Conveyor Belting extra life where it counts

Punishment at the edges—especially the tough use dealt out in mining—can kill most conveyor belting in a fraction of the lifetime of Thermoid-Quaker Conveyor Belting. The unique "COLEDGE", though, available on all grades of Thermoid-Quaker Belting, puts more rubber where it's needed, makes a more flexible and wear-resistant edge where abrasion is greatest. Tests show Thermoid-Quaker Belting with "COLEDGE" construction lasts and lasts on the same jobs where other belting fails.

What's more, all Thermoid-Quaker Conveyor Belting is *prestressed* in manufacture, so that the belt is actually in compression when you get it—ready for the heaviest load without strain.

Examine Thermoid-Quaker Conveyor Belting with the exclusive "COLEDGE" construction at your Thermoid distributor's, or write for further information to *Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 24, Pa.*

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perature and pressure to produce zinc sulphate solution and elemental sulphur. Recoveries of from 95 to 99 percent of the zinc have been reported. The presence of iron in the zinc sulphides does not seem to interfere with or complicate the recovery of zinc.

ONTARIO—The **Joseph Dixon Crucible Company** of Jersey City, New Jersey has taken an option on a large graphite desposit in Bastard Township of Leeds County. Exploration is under way. Mineralization has been traced for 2,000 feet on the surface, and is up to 200 feet wide. It could easily be mined by open pit if there is sufficient tonnage.

SASKATCHEWAN—**Continental Potash Corporation's** shaft sinking is already down below 1,675 feet on its way to 3,300 feet. A drilling station is being made at the 1,650-foot level. The water-bearing zones that occur intermittently beween 1,750 and 2,050 feet will be frozen. From 2,050 feet to the potash beds, the shaft will then be in limestone. This property is near Unity, Saskatchewan.

NORTHWEST TERRITORIES—Work will continue through the winter at the **Taurcanis Mines'** gold property, located about 110 miles northeast of **Consolidated Discovery Yellowknife Mines.** The shaft was completed to the 670-foot level, and levels established at 325-, 475-, and 625-foot horizons. Initial lateral work will be concentrated on the 325 and 625 levels. Necessary hydroelectric power should be available in 1962 but generating equipment on the property can meet requirements until then.

ONTARIO—**North Coldstream Mines** (formerly **Coldstream Copper Mines**) has let contracts for deepening its shaft 650 feet and establishing four new levels at its recently reopened copper property in the Shebandowan area, 90 miles west of Fort Williams. The mine was closed early last year because of low copper prices, but has now been dewatered. **Boland Development Company** will do the shaft sinking. An underground crusher is to be installed below the 1,400-foot level which will be the deepest of the four new levels.

NEW BRUNSWICK—Shaft sinking has been started by **St. Stephen Nickel Mines** on the Maine border about 65 miles west of St. John. The shaft will be 300 feet deep. Development work will be done on two levels. Drilling has indicated 1,000,000 tons of nickel-copper material in the Rogers zone and another 250,000 tons in the Hall-Carroll zone. Surface drilling will be continued to test 10 anomalies indicated by geophysical work on the original property, as well as on an adjoining block of 80 claims.

BRITISH COLUMBIA—An initial shipment of 7,000 tons of iron concentrates was shipped to Japan by **Haulpai Enterprises Corporation** from its property at Head Bay on Nootka Sound, Vancouver Island. The firm leases the property from **Canadian Collieries Resources Ltd.** The camp is erected on floats but the concentrator and shops are on the beach. Logs boomed and anchored about 100 feet offshore serve as a temporary wharf for loading ocean going vessels. Mining is by open pit.

QUEBEC—**Eastern Metals Corporation** has been reorganized and has changed its name to **Territory Mining Company.** Increased financing will pay off liabilities and leave about $60,000 for exploration, according to Andrew Robertson, president. A 60-claim iron prospect will be acquired. Work is at the old copper property in Montmagny County may also be resumed.

BRITISH COLUMBIA—**Fort Reliance Minerals Ltd.** has resumed drilling on its **Toad River** copper prospect in northeastern B.C. The present program will test the zone at vertical depths in excess of 200 feet. Last year's program of 10 holes was to shallow depths along a length of 600 feet of the 1,100-foot strike length.

LABRADOR—According to the Premier of Newfoundland, **Iron Ore Company of Canada** will spend $75,000,000 next year to build an iron ore processing plant in the Carol Lake region of Labrador. The plant will produce up to 6,000,000 tons of iron ore concentrates annually. The concentrates, averaging around 70 percent iron, will be mixed with direct shipping ore from Knox Lake to upgrade the latter. A 100-ton-per-day pilot plant is now in operation.

OCEANIA

QUEENSLAND—The year ended in June 1959 set another record for **Mt. Isa Mines Ltd.**, despite talk of a 25 percent cut in lead output. Copper production rose 35 percent by 10,780 tons to 41,915 tons. Silver-lead bullion increased from 50,960 tons to a record 57,035 tons. 1,356,163 tons of copper ore were treated and 922,416 tons of lead-zinc ore. The firm is pushing ahead with its plans to expand ore production to 14,000 tons per day, from its present 8,000 tons per day.

REPUBLIC OF THE PHILIPPINES—A mining and industrial group headed by Col. Andres Soriano and H. J. Belden, both associated with **Philippine Iron Mines**, has been negotiating with **Yawata Iron and Steel Company** about a steel mill in the Philippines. The Japanese firm reportedly is interested in participating in this as a joint venture. Philippine Iron Mines presently is the islands' largest iron ore producer and makes all of its shipments to Japan. The Philippine government has been discussing a steel mill project for some time. Recently a group of six local firms offered to build one at Iligan for a reported $25,000,000 to $30,000,000 less than the government's **National Shipyards and Steel Corporation** expected to spend.

WESTERN AUSTRALIA—**Rio Tinto Ltd.** is reported to be considering a £10,000,000 investment in Western Australia. The firm's Australian assistant exploration manager has been inspecting titanium mineral leases near Albany, 250 miles southeast of Perth, and the managing director of **Rio Rinto (Aust.)** has had some general discussions in Perth on mineral prospects in Western Australia.

REPUBLIC OF THE PHILIPPINES—The **National Economic Council** plans to recommend safeguards for its high-grade iron ore reserves which are now listed in the new barter law. The law provides no specifications as to ore grades eligible for certification by the NEC as barterable, and apparently favors the grant of barter privileges to all classifications. To prevent depletion of these high-grade reserves through barter exports to Japan, some limits will probably be recommended. The NEC rejected refractory chromite as a barterable item but approved barter privileges for metallurgical chrome ore. Consolidated Mines Inc. has protested this ruling since it claims metallurgical chrome "is of higher quality and commands a much higher price in the market than refractory chromite . . . and is discriminatory against refractory chromite."

NORTHERN TERRITORY—The shaft of **Peko Mines N.L.'s Orlando** gold prospect is now at 100 feet. Crosscutting on the orebody at 200 feet will begin soon. The shaft will be sunk to 400 feet.

REPUBLIC OF THE PHILIPPINES—**Philex Mining Corporation** milled 46,924 dry short tons of disseminated ore at its **Santo Tomas II** mine in Mountain province during July. This is the highest achieved since start of operations a year ago. From this ore, the firm produced

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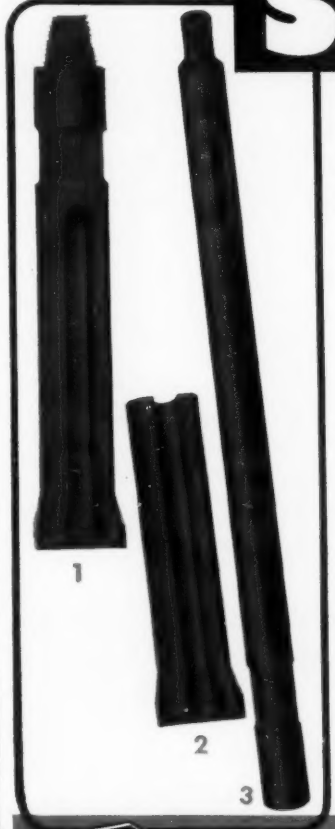

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1,010.75 dry short tons of concentrates averaging 25.71 percent copper and 1.169 ounces gold per ton. Metal content of the concentrates is estimated at 516,361 pounds of copper and 1,219.42 ounces of gold. The July output was the first time that Philex's copper production had exceeded 500,000 pounds in one month.

NEW GUINEA—In the year ended May 31, 1959, **Bulolo Gold Dredging Ltd.** dredged 4,855,605 cubic yards to recover 20,140 ounces of fine gold, compared with 5,456,900 yards dredge in the previous year to recover 23,939 ounces. The earnings from gold production by Dredge No. 5 and the Widubosh sluicing operation were a little higher than in the previous year.

REPUBLIC OF THE PHILIPPINES —**Manila Mining Corporation** reports good progress in its prospecting of copper and gold claims in Agusan Province. Several veins have been opened and over 400 samples taken and assayed. The firm is making plans for a mine access road from the main highway to the principal copper-bearing area.

NEW ZEALAND—A borehole survey recently completed on the coastline north of New Plymouth (North Island) indicates that Lake Taharoa, south of Kawhia Harbour, is potentially the most important ironsand deposit on the whole coastline. Although deeper drilling is needed, indications are that the deposit may contain 173,000,000 tons. The survey was made by the New Zealand Department of Scientific and Industrial Research.

REPUBLIC OF THE PHILIPPINES —**Itogon-Suyoc Mines Inc.** hopes to have its Suyoc mill in Mankayan in full operation (300 tons per day) by the end of this year. Within the first 15 days after opening in June, the mill had recovered 205 ounces of gold, and within two months it was operating at about 75 percent of rated capacity. Rehabilitation of old drifts and crosscuts was carried on to reach the ore body in the North Block of the mine.

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AFRICA

UNION OF SOUTH AFRICA—In the vicinity of the proposed site for its new 22-foot-diameter shaft in the southwest section of the mine, **Free State Geduld Mines Ltd.** has intersected the Basal Reef at 4,400 feet. The borehole was drilled to determine the depth of that shaft. Values showed 197 dwts over 5.28 inches, or 1,040.2 inch-dwts. Results of two deflections are awaited. The borehole, about 4,300 feet south of the No. 1 shaft, is particularly interesting because it lies between the zone of great enrichment recently reported, a little more than 1,000 feet east of the last-known point reached by 47 Level drives and some 2,000 feet south of 45 Level drives, and Geduld No. 1 borehole about 5,200 to the west. Initially, the proposed shaft will be divided into a downcast ventilation section for hoisting and an upcast ventilation section.

FEDERATION OF RHODESIA & NYASALAND — **Nchanga Consolidated Copper Mines Ltd.** is continuing prospecting work in the Chingola and Mimbula ore bodies and has dewatered the River-Lode for revaluation with a view to further prospecting. This work is expected to add considerably to the present calculated ore reserves of 167,000,000 tons. At the same time, metallurgical research is continuing on recovery of copper from banded sandstones lying above the main ore body. If a fully successful method can be found, large tonnages of low-grade ore could be drawn for treatment from current and old workings, as well as from the Nchanga open-pit, without further major expenditure on development.

GHANA—**Ariston Gold Mines (1929) Ltd.** has found excellent gold values in lower levels of the No. 2 ore body. Driving on the 27th level has disclosed a higher gold content as work has progressed southward. The most southerly crosscut has given 9.9 dwts. over 215 inches or 2,128 inch-dwts.

FEDERATION OF RHODESIA & NYASALAND—A 10 percent cut in copper production has been announced by the **Rhodesian Selection Trust** group (**Mufulira, Roan Antelope,** and **Chibuluma**) as a contribution to a reduction in present world copper overproduction. The **Anglo American** group (**Nchanga,**

Rhokana, and **Bancroft**) has advised that its future rate will not be at the same rate as for the first six months of 1959. It is generally accepted that any output restrictions will be based on the record production of the first six months of the year. If this is so, the net effect will be to bring Northern Rhodesian production back to "normal," which will be appreciably in excess of the output prior to the previous cutback of 1958-1959.

NIGERIA—**Naraguta Extended Areas Ltd.** is taking steps to effect a partial diversion of the Delimi River in order to reach the potential tin ore reserves discovered two years ago in the river bed.

UNION OF SOUTH AFRICA—Highlights of shaft sinking now in progress at Transvaal and Orange Free State gold mines: At **Buffelsfontein Gold Mining Company Ltd.'s** property, sinking of the sub-vertical shaft in the northwest section is underway. At **Stilfontein**, the Toni Shaft is well along and the James Shaft is now in its initial stage. Preparations for sinking the No. 2 shaft system in the south-central section of the **Vaal Reefs** lease area are being completed. **St. Helena Gold Mines Ltd.** has sinking operations well advanced for the mine's fourth shaft, in the east-central section. **Free State Geduld Mines Ltd.**, has completed the supplementary ventilation shaft in the No. 2 shaft area. Development continues in the severely faulted zone southwest of No. 1 shaft, where 2,447 feet were driven, 370 feet sampled, and all were payable, averaging 7,118 inch-dwts., compared with 9,772 inch-dwts. over 215 feet in the previous quarter. Future results from the zone will be included in the aggregate values for the No. 1 shaft area.

NIGERIA—Due to tin output restrictions that still prevail, **the Gold and Base Metal Mines of Nigeria, Ltd.** has not resumed full-scale production of tin and columbite. However, increased demand for columbite in recent months has persuaded the company to raise production at Liruie to 50 tons for 1959. In 1957 Liruie produced 360 tons of tin concentrates and 122 tons of columbite.

UNION OF SOUTH AFRICA—The sharp rise in platinum prices and the disposal of a portion of refined platinum and other stocks has enabled **Rustenberg Platinum Mines Ltd.** to repay the £1,000,000 loan borrowed from the Standard Bank of South Africa to finance last year's deficit. Rustenberg mines the Merensky reef, known as the world's largest reserve of platinum, located in the Transvaal.

UNION OF SOUTH AFRICA—With the support of the government and some of the country's largest industries, the **South African Atomic Energy Board** will spend about £800,000 a year on a research program aimed at lower costs and simplified processes of uranium production in order to enable the country's output to compete effectively in the world market. The research program will also investigate production and processing, into more readily marketable forms, of such mineral deposits as titanium, zirconium, and beryllium. The program includes acquisition of an atomic reactor. Students selected for the program are already attending research centers overseas to further their knowledge.

YUGOSLAVIA—During the past year, a new lead-zinc mine has been under development at **Sase** on Ruen Mountain near the Bulgarian border. Over 1,000,000 tons has been estimated so far, with 5 percent lead and 5 percent zinc. South of the mine a flotation plant will be built to treat 300 to 500 tons of ore per day. Since the Trepca smelters are now operating at full capacity, some consideration is being given to erection of another lead smelter which could handle ore from Sase and also from the **Zletovo** mines north of Stip in Macedonia.

SPAIN—The Spanish government has approved greater foreign capital participation in Spanish mining companies. A new decree permits foreign investment of 50 percent or more, where formerly it was between 25 and 45 percent. Many mining companies in need of new equipment and machinery now hope to make arrangements with foreign investors. Iron ore miners hope for a revival of exports since the devaluation of the official peseta rate

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SWITZERLAND—The International Exhibition of Laboratory, Measurement and Automatic Control in Chemistry will be held in Basle from November 10 to 15. Meeting at the same time will be two technical congresses—the **Association of Swiss Chemists** and the **Swiss Federation of Automatic Control**, and the 22nd Meeting of the **European Federation of Chemical Engineering**. Thirty main lectures have been planned, with speakers coming from Belgium, Germany, France, Holland, the U.S.A., and Switzerland.

FINLAND—The **Outokumpu Mining Company's** development of the pyrite deposit at Pyhajarvi in northern Finland will be undertaken with the aid of a West German Bank Loan for Reconstruction (The German bank will lend DM50,000-000 to the Mortgage Bank of Finland). Recent work at the property indicates a reserve sufficient for 30 years of operation. Initial output is to be around 600,000 tons of ore annually, yielding about 5,000 tons of copper and 18,000 tons of zinc, as well as 360,000 tons of iron pyrites. This will bring total zinc output for the company to about 80,000 tons annually.

SWEDEN—The new 515-meter level of the **Grangesberg** mine, operated by **Trafik ab Granesberg Oxelosund,** is now prepared for production. The mine is being developed to increase tonnage of block caved ore which increased from 20 to 75 percent in the period from 1920 to 1958. Production in 1958 totaled 1,700,000 metric tons of iron ore. During the 1920 to 1958 period, production per working hour also increased: from 0.4 ton to 1.33 tons.

SPAIN—Three new patents have been registered by an industrial research group that specializes in Spanish pyrites. One patent covers the production of ammonium sulphate without passing through the sulphuric acid stage. A pilot plant may be erected to produce 50,000 tons annually. Another patent eliminates the problems of arsenic content in the processing of pyrites. A third patented process facilitates extraction of small copper and zinc content from pyritic ore before processing it for iron production.

NORWAY—Now in production is the **Aardal II** aluminum plant of **A/S Aardal og Sunndal Verk,** Norway's state-controlled aluminum works, bringing production from Aardal to 65,000 annually. With the completion of **Aardal III,** production will increase to a probable 100,000 tons. Including the output from the company's plants at Aardal and Sunndal, combined capacity will reach 200,000 tons per year.

UNITED KINGDOM—Since the beginning of this year **South Crofty Ltd.,** near Camborne, Cornwall, has been operating its tin mine at a profit. April and May output reached 78 and 76 tons, respectively, with milling at 8,000 tons per month. Financial and trading losses shown by the 1958 annual report were due to the fall in tin prices, reconstruction costs accompanying the installation of a rod mill and other plant machinery, and the fact that benefits of the increased 1958 tonnage were not felt in that year. During 1958, 75,596 tons of ore were treated, compared with 70,633 tons in 1957. Output of tin concentrate increased by 16 tons. Development increased by 501 feet, and nearly a thousand more feet of diamond drilling were achieved than in the previous year.

EIRE—**Abbeytown Mining Company Ltd.** reportedly has reopened its lead-zinc mine at Ballisodare, Sligo county.

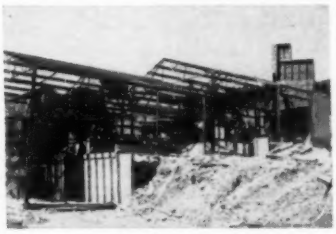
ENGLAND—A new firm, known as **Consolidated Beryllium, Ltd.,** has been formed by **Imperial Smelting Corporation Ltd.** of London and the **Beryllium Corporation** of Reading, Pennsylvania. Imperial Smelting is a wholly owned subsidiary of **Consolidated Zinc Corporation Ltd.** The new firm will be managed by Imperial Smelting and will produce nuclear-grade beryllium metal and beryllium-copper master alloy as raw materials for sale to manufacturers in England and Europe. It will be the United Kingdom's first operation of this kind. For the past six years Imperial Smelting has done research and process development on beryllium production, including work done under contract for the U. K. Atomic Energy Authority. It will complete an initial beryllium plant at Avonmouth this year, which the new firm will operate.

EIRE—Diamond drilling continues at **Silvermines Lead and Zinc Company, Ltd.,** of Shallee, County Tipperary. Some 350,000 long tons of barite have been proved to date, with an additional 350,000 tons indicated.

The Market Place

W. R. Wade

Consulting Mining Engineer



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1—No. 6½ Vulcan Single Drum Mine Hoist, Clutch, Brake, 6500# Rope Pull, Drum 48" x 36". Electrics to suit.

1—1435 CFM, Type XCB, Ingersoll-Rand Stat. Horiz. 2-Stage Air Compressor, motor and drive.

1—1575 CFM, Type XCB, Ingersoll-Rand Stat. Horiz. 2-Stage Air Compressor, Motor and drive.

1—No. 40-H Eimco Mucking Machine, 36" Ga. equipped 24" Ga. pony trucks.

1—4-Cell, No. 18 (28" x 28") D. E. Sub-A Flotation Machine.

1—5' Dia. x 9' Long Kennedy H.D. Ball Mill.

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Rod Mill: 4x10 Hardinge periph. end dis.
Rod Mill: 2x4 Marcy w/new liners, etc.
Filters: 6 ft. 3-leaf Eimco w/gearmotor, etc.
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32—33 cu. ft. Ajax Type, 18" ga.
25—60 cu. ft. C.S. Card, Granby, 30" ga.
29—57½ cu. ft. Ajax Type, 18" ga.
14—84 cu. ft. C.S. Card, Granby, 30" ga.
5—85 cu. ft. C.S. Card, Granby, 30" ga.
8—93 cu. ft. C.S. Card, Granby, 24" ga.
7—100 cu. ft. C.S. Card, Side Dump, 30" ga.
14—130 cu. ft. C.S. Card, Granby, 30" ga.

CLASSIFIERS
1—36" x 15'-0", Wemco, Model SCM, Spiral
1—45" x 17'-3", Akins Spiral w/drive
1—6' x 22' Dorr Duplex, Rake, w 5 HP
1—7' x 25'-6" Dorr DSFX, Rake Type

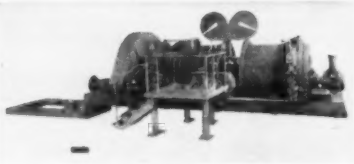
COMPRESSORS
1—500 CFM Gardner-Denver, HAC, 100 HP, 440V
1—875 IR XRE 175 HP, Syn. 2200V
1—1000 CFM Chicago Pneumatic, OCB, 200 HP, 440V
1—1050 CFM G.D., HA, 200 HP, G.E. 2200V
1—2000 CFM Worthington, 400 HP, 2300V
1—2500 CFM Sullivan, WN4, 400 HP, West., 2200V
1—3000 CFM Ingersoll Rand PRE-2, 575 HP, 2200V

CONVEYORS
1 ea. 18" x 14' Pioneer, Steel Frame, 1½ HP Motor
1 ea. 18" x 155' Link-Belt, Steel Frame, W/Motor
1 ea. 18" x 178' Link-Belt, Steel Frame, W/Motor

CRUSHING PLANT
1—Pioneer, Model 40V, Portable, Complete
1 ea. Cedar Rapids, Pit Master, 10 x 16 Jaw, Port. Complete.

ENGINES, DIESEL
1—GMC, Model 671 RC, Elec. Start, PTO, 150 HP
1—Duetz, air cooled, Type A12L614, PTO., Excellent 600 HP, Vulcan Dbl. Drum Hoist

FLOTATION MACHINES
1—1 cell Wemco, 44", 5 HP Motor
1—1 cell Denver, #18 Sp. 32" 3 HP Motor
4—2 cell Gallgher, 48", 15 HP Motor
1—2 cell Denver, #21, 38" x 38"



10—2 cell Fagregren, 56" x 56", 14 S.
1—5 cell Wemco, 44", 5 HP Motors
1—5 cell Denver, #18, SP. 32", 7½ HP
2—3 cell Fagregren 56" x 56", 14S.

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1—75 Caterpillar D 13,000 220/440 Volt, Diesel

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1—40 HP Coeur d' Alene Single Drum, Excellent
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11—5 NNIG Ingersoll Rand, 2 drum, 220/440 V.
2—AAF212 Sullivan, 2 drum, 15 H.P. 220/440 V.
1—C-111 Sullivan, 1 drum 40 HP, 220/440 V.
1—30 MNM 3D Ingersoll Rand, 3 drum, 30 HP, 220/440 V.
2—CF211 Sullivan, 2 drum, 50 HP, 440 V.
3—FF211 Joy, 2 drum, air
4—A4NNOJ, Ingersoll Rand, 2 drum air
4—HKE Gardner Denver, 2 drum, air
1—K4U Ingersoll Rand, 1 drum, air 3000#
5—HK Gardner Denver, 1 drum, air, 2000#

Write For Complete Inventory Listings

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1—8" x 10" Denver, Type H, New
1—8" x 24" Union Iron Works, 30 HP Motor
1—15" x 36" Universal, 50 HP, G.E. Motor
1—8" x 16" Cedar Rapids, Less Motor

JIGS
3 ea. 12" x 16" Denver Duplex, w/motor
2 ea. 26" x 26" Bendalari, Simplex, w/motor
1 ea. 42" x 42" Bendalari, Duplex, w/motor

LOCOMOTIVES
16—1½ Ton Mancha Battery, 18-24" ga.
3—1½ Ton Atlas, Type J, Battery, 18" ga.
1—2½-3 Ton Jeffrey, 18" ga.
1—3½ Ton Mancha Titan AX, 18" ga.
3—Universal Tramaire, Air, 18"-24" ga.

MILLS
1—Complete Plant, 450 Ton Flotation, Complete w/steel bldgs.

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1—3' x 8' Hendy Rod Mill, 30 HP
1—4' x 5' Colorado Iron Works, 30 HP
3—5' x 14' Marcy Ball Mill, 100 HP
1—6' x 16" Hardinge Conical Ball Mill, 50 HP
5—8' x 9' Traylor Ball Mills, 250 HP
1—5' x 8' Traylor Rod Mill, 150 HP

PUMPS
1—2" Oliver United Filters Centrifugal, 2" Suction
1—3" Byron Jackson, Centrifugal Water Pump, 40 HP, 440 V
1—6" Weinman Centrifugal, 1000 GPM, 140' Head, 100 HP, 440V
3—Allen Sherman Hoff Hydroseal Sand Pump, 4"
1—Ash Hydroseal Sand Pump, Rubber Lines 2"
1—Denver Vertical Centrifugal Sand Pump, 1½"

SCREENS
1 ea. 18" x 24" Denver Dillon, w/motor
1 ea. 2' x 4' Denver Dillon, w/motor
1 ea. 3' x 6' A.C. Aerovibe, Single Deck, w/motor
1 ea. 3' x 6' A.C. Low-Head, Single Deck, w/motor
1 ea. 3' x 7' Link-Belt, Type PD, Single Deck
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1—A1.-Ch compeb 7' x 24", 400 HP
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1—Marcy Rod, 7' x 15', 4" liners, 300 HP.
1—Kennedy 4' x 8' rod, 50 HP, EPD
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1—Hammermill, Penna. Crusher 400 HP, non-clog, #5060, UNUSED.
1—Gyratory Crusher: Kennedy #49, 100 HP.
3—Raymond roller Mills: #5057, #6058

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9—Ingersoll-Rand Model EUA
1—Ingersoll-Rand Model 10-H
8—Gardner-Denver Model HK
2—Joy "Turnbinair" Model F-113
1—Sullivan Model L-111
2—Ingersoll-Rand Model 10HR
1—Sullivan Model HA 3
3—Ingersoll-Rand Model H4

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2—7½ HP Sullivan tuggers
1—15 HP Ingersoll-Rand size 15NN-IG, 2 drum slushers

1—30 HP Joy Double Drum Slusher
1—60 HP Sullivan 3 Drum Slusher

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1—2' Symons Cone
1—1'8" Traylor, Type TY.
1—12" Traylor, Type T

BALL AND ROD MILLS
1—4' x 4' Marcy Ball Mill
1—6' x 4' Hardinge Conical Ball Mill
1—41/2" x 4' Hirsch Ball Mill
1—64½ Marcy Ball Mill
1—8' x 22" Hardinge Conical Ball Mill
1—3' x 8' Morse New Rod Mill
1—5' x 10' Allis-Chalmers Ball Mill

JAW CRUSHERS
4—2¼" x 3½" New Morse Lab Crushers
3—4" x 6" New Morse Lab Crushers
1—5" x 6" New Morse Jaw Crusher
1—6" x 7½" Hendy Crusher
1—9" x 16" Kue-Ken No. 30 Crusher
1—10" x 20" Pacific Crusher
1—20" x 36" Diamond Roller Bearing, Steel Plate, Jaw Crusher

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2—5 Ton General Electric Battery Locomotives
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2—8 Ton General Electric Battery Locomotives
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4—10 Ton Atlas Battery Locomotives
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WANTED Bauxite property. Advise us as to location, analysis, drill data, ore blocked out, etc. Navajo Mineral Fund Inc., 6123 Maryland Drive, Los Angeles 48, California.

CLASSIFIED ADVERTISING

PRODUCT ENGINEER MINING EQUIPMENT

East Coast Manufacturer seeks engineer for Sales Department. Will coordinate equipment inquiries and sales activities with Engineering and other departments, assist in preparation of sales reports and prepare estimates and proposals for mining equipment. Prefer Mining Engineer with 1-3 years experience in application of materials handling equipment for mining industry. Submit resume and salary desired to Box P-3, Mining World, 500 Howard Street, San Francisco 5, Calif.

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BARITE: Marcotte barite deposit, 12 claims, Clark mining district, Graham county, Arizona. A. J. Marcotte, Box 52, Klondyke, Arizona (no phone).

MINE OPERATOR NEEDS financing on mine containing Gold, Silver and Lead near Elko, Nevada. Operator has $40,000 of mining equipment. Write J. R. Davies, Box 1185, Elko, Nevada.

FOR SALE OR LEASE: Land containing talc, gold, copper and other minerals. Address all communications to P. O. Box 22, Seagrove, North Carolina.

DENVER adjustable stroke DIAPHRAGM PUMPS

Model E

NOW...Smaller Pumps That Do As Much As Larger Pumps Used To Do!

For example:

3" DENVER Pump..... 45 GPM capacity
4" Other Pumps..... 45 GPM capacity

Now you get the capacity of the larger pump, plus line velocity engineered to keep solids from settling. Feed line velocity is uniform throughout the complete line of DENVER Pumps.

You save on initial cost—on maintenance. You get simple, compact design—rugged dependability.

Buy Your Pump by Capacity—Not Size!

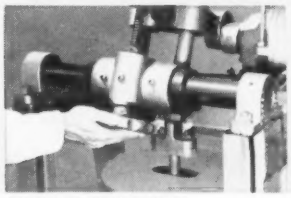
Table below shows new capacities of DENVER Pumps by size. Compare with the pumps you may now be using. Why pay more for a bigger pump when a smaller DENVER Pump will do as much? Determine the capacity required for your operation—then select the pump that does the job.

NEW DENVER ADJUSTABLE STROKE DIAPHRAGM PUMPS

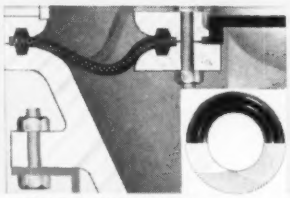
DENVER Pump Size	Capacity—GPM* SIMPLEX	DUPLEX	Line Velocity At Listed Capacities
2"	20	40	2.00 ft./sec.
3"	45	90	2.00 ft./sec.
4"	70	140	2.00 ft./sec.
5"	120	240	2.00 ft./sec.
6"	175	350	2.00 ft./sec.
8"	320	640	2.00 ft./sec.
10"	500	1000	2.00 ft./sec.

*at maximum stroke and normal speed. Stroke can be adjusted while pump is operating.

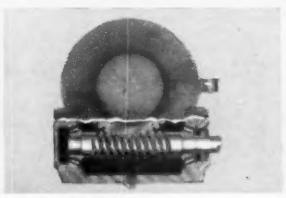
Sizes from 1" to 10", simplex and duplex, in capacities up to 1000 GPM—standard or acid-proof construction.



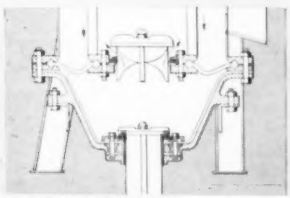
POSITIVE ADJUSTMENT and control are made while pump is operating by turning conveniently located handwheel. Improved design permits longer strokes, greater capacity.



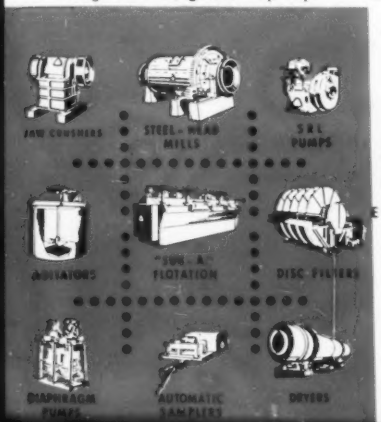
IMPROVED DIAPHRAGM is rubber, molded with patented spiral nylon cord construction to withstand constant flexing and permit longer stroke that boosts capacity up to 75%.



POWER ECONOMY results from anti-friction bearing design and simplified, efficient, running-in-oil drive. Reduces maintenance, assures long, trouble-free operation.



EASIER MAINTENANCE provided by simple design and such features as long wearing tough rubber valve seats that can be quickly and easily replaced.



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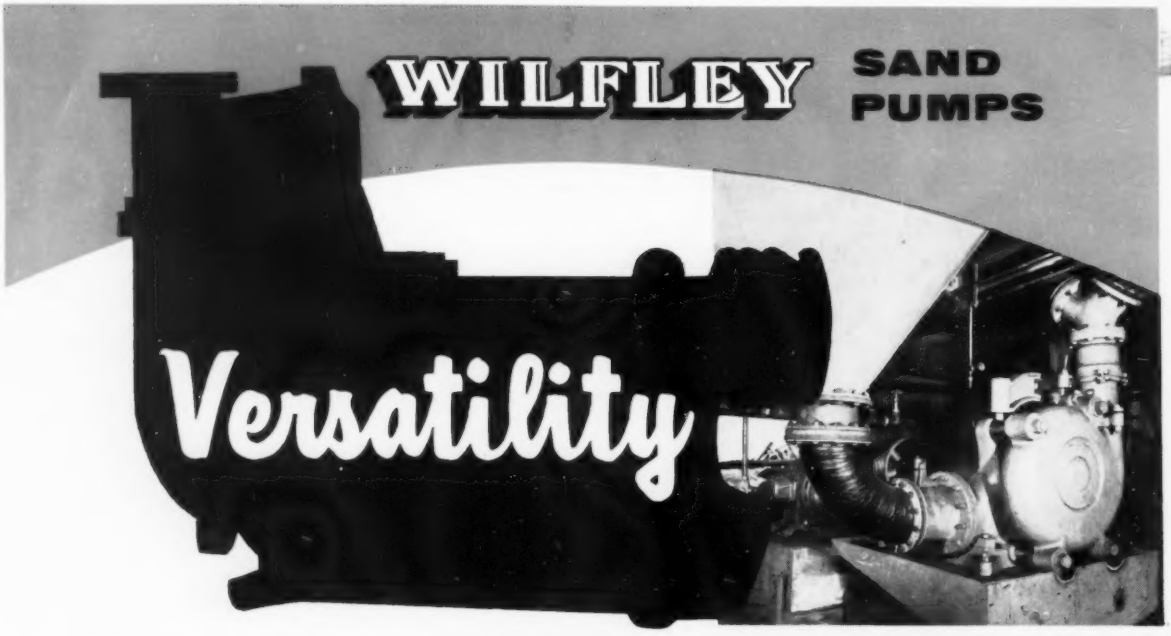
WILFLEY SAND PUMPS



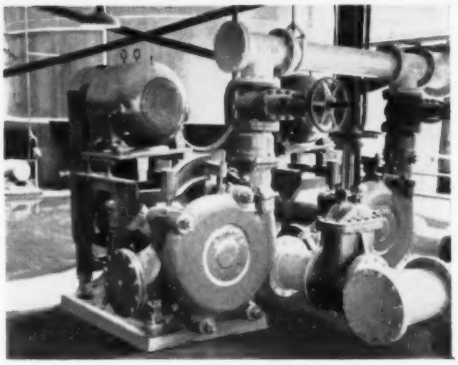
Versatility

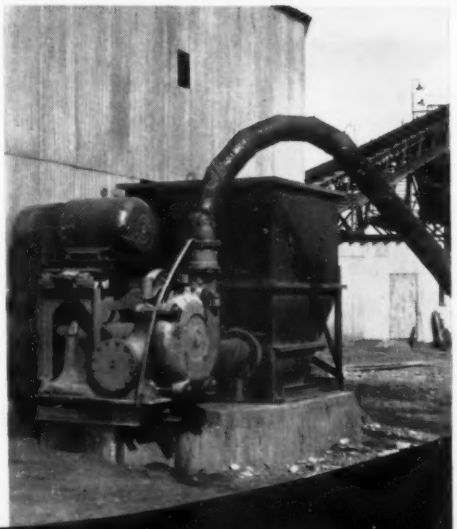
to Solve Your SPECIFIC Pumping Problems

Every year the applications for Wilfley Sand Pumps become more varied. So **many** industries now require low cost pumping of sand, slimes, slurries—abrasive solutions of all types. Wilfley Sand Pumps are designed to meet all requirements in the transfer of solids. They may be fitted with interchangeable electric furnace alloy iron, special application alloys, or rubber-covered wear parts. Whether you need belt driven, overhead V-belt driven, or direct driven pumps, Wilfley has them—available in **1", 1½", 2", 2½", 3", 4", 5", 6", 8"** and **10"** discharge sizes with capacities to 3600 GPM and heads as high as 200′.

This all-around versatility plus continuous, maintenance-free performance and longer pump life make Wilfley the No. 1 choice of economy-minded plant operators throughout the world. To give you maximum economy in solids pumping, every Wilfley installation is **Job Engineered.**

Write, wire or phone for complete details.





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